Volume 27 JUNE, 1921 Number 10

MACHINERY

THE INDUSTRIAL PRESS Publishers, 140-148 LAFAYETTE ST., NEW YORK

VOLUME 27 **MACHINERY** NUMBER 10

JUNE, 1921

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Published monthly. Yearly subscription in United States and territories $3, plus $1 Zone postage west of Mississippi and in Alaska, Hawaii, Philippines, Porto Rico, Canal Zone, Cuba and Mexico; Canada, $4.50; foreign countries, $6; single copies, 35 cents, postage extra. A subscription is acknowledged by sending the current number. Checks and money orders should be made payable to THE INDUSTRIAL PRESS.

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Circulation for May, 1921, 20,850 Copies

Member Audit Bureau of Circulations

Entered as second-class mail matter, September, 1894, at the Post Office, in New York, N. Y., under the Act of March 3, 1879.
It is understood that all contributed articles pertaining to machine shop practice and machine design are submitted exclusively to MACHINERY; when accepted and published, payment is made at our regular space rates unless other terms have been agreed upon.

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The Editor's Monthly Talk

WHAT the technical journal offers its readers is, or aims to be, something other than entertainment; but the technical journal is in competition with all the professional and amateur entertainments which beset the modern man on every side. The range of attractions is wide, including the ever-present and ever-changing movies. The function of a journal like MACHINERY is to be useful rather than diverting, technical and practical rather than beguiling.

It speaks well for the men who operate our manifold industries that, notwithstanding the diversions on every hand which make so strong and constant an appeal for their time, money and attention, they continue to give not only splendid but ever-increasing support to the journal of serious and definite purpose. Trade and technical journalism never had so many readers—serious readers—who mean to master all the technical details of the greatly diversified industries in which they are at work, and it is more than likely that the measure of success which comes to each journal in its special field is about equal to its merit, not as entertainment, but as practically useful, educational and reliable.

When Does Automatic Machinery Pay?

The question above is timely. Not all automatic machinery pays, however ingenious or efficient. It often happens that automatic machinery is designed for work which can be done just as well by relatively inexpensive hand-operated machinery. The natural tendency of the progressive machine designer is to develop machines and devices that will work automatically, but it often happens that the first cost of such a device may be out of proportion to the number of parts to be made. Where quantity production is required, the machine may pay for itself in a very short time, but where quantities are limited it may never pay for itself.

The article in June MACHINERY, "When Does Automatic Machinery Pay?" discusses the fundamental points which must be considered before any attempt is made to provide automatic machinery for machining operations: Can an automatic machine be designed which will turn out a thoroughly satisfactory product? How much will it cost? What production rate will it give? How much attention will it need to keep it in running order? These practical points are considered in detail, and the methods for reaching satisfactory conclusions with reference to each question are definitely outlined.

Accuracy in Drawings

In the article, "Common Causes of Errors in Machine Design," in June MACHINERY, the author emphasizes the great importance of making drawings absolutely accurate, in order to avoid misunderstandings likely to be very costly during production. By correct drawings the author means not merely technically correct—that is, that there should be no errors in dimensions, but accuracy in design and in the mechanical principles involved. The designer should not be too quick to discard an old design or too critical of some unfamiliar construction or shape of a part previously used. Very likely there are good reasons which were carefully thought out in the past, and it is as risky to discard the old without careful consideration as to reject improvements when not obviously advantageous.

The successful designer must be always on the alert; he must compare the old and the new, the results of past experience and the ideas for new developments. MACHINERY has published nothing more definitely useful than this series. Some of the points covered may appear elementary, but they are not elementary when considered in the broad manner in which the author handles his important subject.

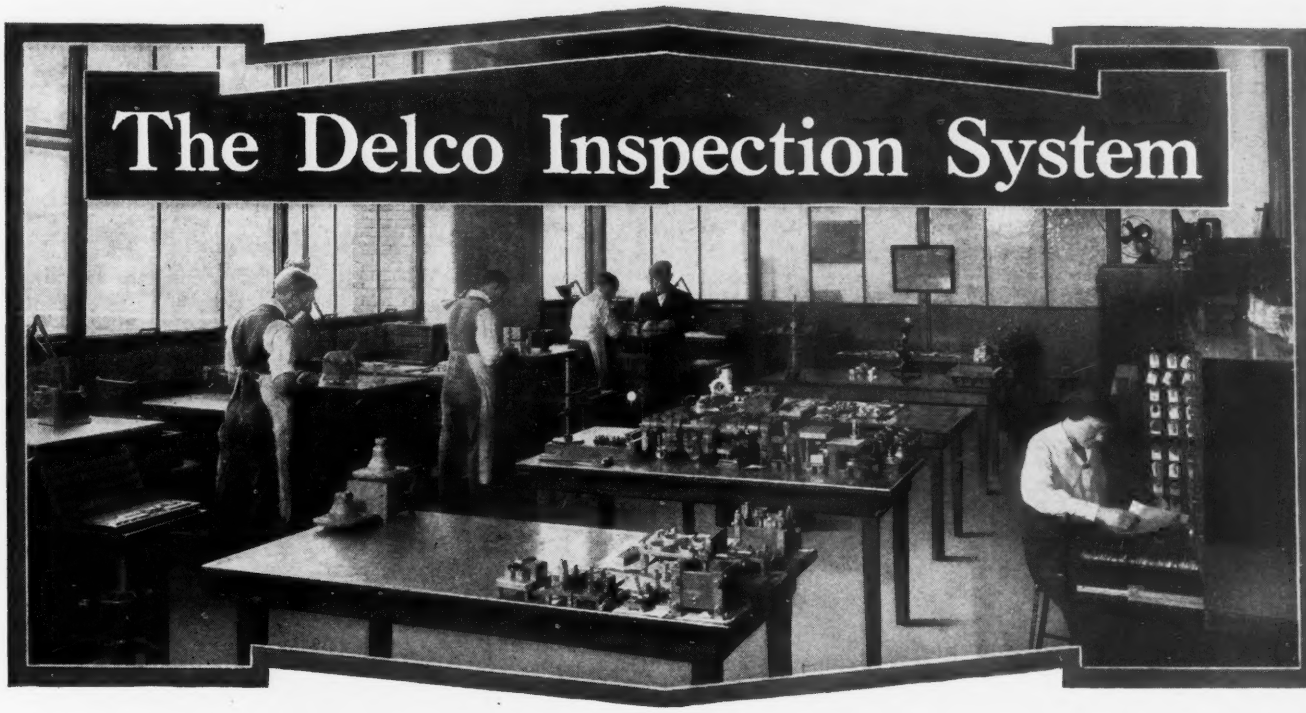
Dealing with Selling Problems

To make an article is one thing and to sell it is quite another. The basic principles of a successful selling organization are discussed in June MACHINERY by Howard W. Dunbar, sales manager of the grinding machine division of the Norton Co., Worcester, Mass. Mr. Dunbar is definite and specific. He discusses the work of the machine tool salesman, the duties of the selling force, policies in selling machine tools, suggestions made by the customer for modifying design and for special fixtures, the return of machines to the factory for repairs, credit allowances on returned parts and materials, and the salesman's attitude toward complaints.

This is the first of a series by Mr. Dunbar which will be read with a great deal of interest by men connected with the selling organizations, not only of machine tool firms, but of builders of machinery in general, as well as by dealers. The production department will find these articles of particular interest, because in any successful business, quality in production and efficiency in selling must go hand in hand.

Modern drop-forging practice will be covered in a series of articles beginning in July MACHINERY. This series will deal with the work in all its phases, beginning with the lay-out of a drop-forging plant and definitely outlining the equipment required. These articles will cover drop-forging methods, the making of drop-forging dies, heat-treatment of dies and various other operations and problems met with in drop-forge shop practice. In addition, July MACHINERY will contain thorough and up-to-date articles on railway shop practice, cold-swaging dies, the work efficiently performed on crank planers, and numerous brief articles on approved shop practice and machine design.

The Delco Inspection System



A Description of the Methods Used by the Dayton Engineering Laboratories Co., for the Inspection of Raw Materials, Purchased Parts, Tools, Equipment and Gages, and the Manufactured Product*

By LOUIS RUTHENBURG, Superintendent, and R. A. CRIST, Assistant to the Superintendent of the Dayton Engineering Laboratories Co., Dayton, Ohio

THE inspection system used by the Dayton Engineering Laboratories Co. is divided into three main groups: (1) Inspection of raw materials and purchased parts; (2) inspection of tools and equipment; and (3) inspection of the manufactured product. As organized, the inspection division of the Delco plant is divided into five specific groups, known as follows: (1) Tool inspection; (2) parts in process inspection; (3) final inspection; (4) road inspection; and (5) salvage department.

Of these the second division—parts in process inspection—is divided into three subdivisions: (a) Receiving inspection; (b) departmental inspection; and (c) service inspection. Because of the nature of the product manufactured by the Delco plant the final inspection is divided into two sections, the mechanical and the electrical. The duties of each of the different sections or departments and the methods employed will be dealt with in detail in the following.

Receiving Inspection

The first necessity for inspection arises in connection with raw materials and purchased parts. This inspection includes visual examination, both as to quantity and quality, and, when possible, also chemical, mechanical, and electrical tests. It includes the inspection of castings, both while in process in the foundry making them, and when finally received at the Delco plant.

The materials which pass through the receiving inspection department may be roughly classified as follows: (1) Raw materials; (2) semi-finished and finished parts; (3) shop equipment and supplies.

Inspection of Raw Materials

All raw materials, when received, are provided with a green tag, which indicates that the material must not pass to the production departments until this tag has been removed, the removal of the tag being an evidence that the material has been properly inspected. All material received that can be tested either by physical, chemical, or electrical tests has a sample removed from it, which is sent to the laboratory for testing purposes. In this manner the materials are tested to determine that they agree with the predetermined specifications, the purpose of which was explained in the preceding article

The present article on the principle of the Delco inspection system is based on a paper prepared for a training course for executives by the executive training course committee of the Dayton Engineering Laboratories Co. This committee consists of Louis Ruthenburg, superintendent, R. A. Crist, assistant to the superintendent, W. E. Baker, employment manager, and O. T. Kreusser, educational head, working in cooperation with other executives of the Delco organization. The principles laid down, therefore, constitute the authoritative record of the best practice in inspection, as the highly developed and systematic methods of the Delco organization are well known throughout the whole engineering world.

dealing with principles of inspection. Thus, for example, all material, such as bar and sheet stock, is sent to the chemical laboratory for analysis and also for physical tests. At the same time the received material is checked to determine the quantity received, and when this has been done and while the analyses are still being made, the material is sent to the raw stock department, but the green "hold cards" placed on the stock prevent it from being released for the production departments until the chemical laboratory's report of approval has been received.

Raw materials in the form of castings also pass through the receiving inspection department. The rough castings are first inspected as to quantity and weight. Then a hammer test is employed to detect cracks, and in some cases the castings are checked for warpage by a flat surface inspection. As most castings used by the company are annealed and sand-blasted before passing to the manufacturing departments, the castings are routed to the heat-treating department for this process, and then inspected before being machined. Defects often develop while annealing and sand-blasting, and a re-inspection of the castings before they are sent to the stock-room usually will bring to light such defects.

One inspector is in entire charge of the casting inspection. He visits the foundries making the castings twice a week, inspecting both the pattern-making work and the molding. He then inspects the castings after they have been received at the Delco plant, and he also follows them through the machining departments to ascertain that no difficulties are met with in machining them. It is obvious that there is a great advantage in having one man responsible for the inspection of the castings from the time that the patterns are made until the castings are machined. There is no divided responsibility, and hence much less likelihood of anything being overlooked that could be prevented in time. In order to place a double check on received material, the receiving department, which records the receipt of raw materials or parts, counts and weighs everything that comes into the plant, and the inspection department also counts and weighs the materials.

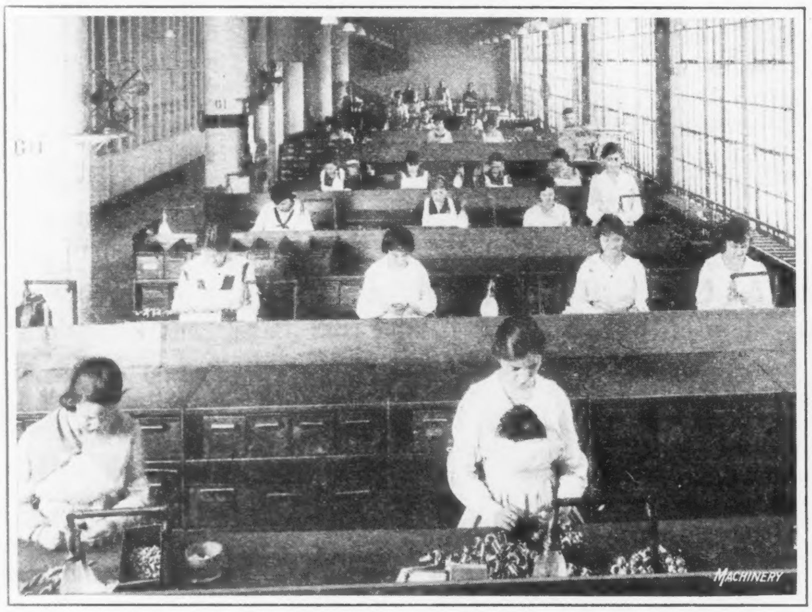


Fig. 1. Typical Inspection Department in the Dayton Engineering Laboratories Co.'s Plant

Inspection of Semi-finished and Finished Parts Purchased from Outside Plants

When orders for parts are placed with outside plants, samples of the finished material ready for shipment are sent by the outside plant to the Delco inspection department before shipment is made. These sample parts are then inspected, and if found satisfactory shipment will be requested and the parts received. Purchased parts which arrive in their finished shape are inspected in the receiving inspection department, and then passed to the stock-room. Ball and roller bearings are carefully inspected, as well as armatures, resistance units, and other parts that are purchased from outside concerns.

The receiving inspection department also counts and records the number of small tools, machine tools, and other equipment that is received. The inspectors attach to each a number, and notify the tool inspection department that such machine tools or small tools have been received, but before the tools or machines are released to the factory, they must be inspected by the tool inspection department, which is held responsible for the equipment.

Under the heading of general equipment and supplies, there are also all kinds of articles ranging from office desks to thumb-tacks which must be checked for quantity and quality. This is done by the receiving inspection department. If the purchased materials do not meet the specifications, "return goods orders" are issued and passed to the purchasing department, and the materials are returned to be replaced by those that will meet the specifications.

Tool Inspection

The tool inspection department, a view in which is shown in the heading illustration, is responsible for the checking of all tools, appliances, machinery, and machine tools. The work of inspection is roughly divided into six classes, as follows: Jigs and fixtures; dies and plug and snap gages; small tools; precision tools and gages; machine tools; and shop appliances. All tools, whether made within the plant or purchased from the outside, must be passed upon by the tool inspection department before being sent into the factory. Tools made in the plant are all checked to the drawing, and are given what is known as a 100 per cent inspection. The inspection department is also given the right to criticize the design and to suggest improvements. The inspectors are specialists, one man, for example, always inspecting dies; another, jigs and fixtures; another, plug and snap gages; while still another works exclusively on drills, taps, threading dies, and small tools purchased from outside manufacturers. When new jigs or fixtures are placed on the job and parts from them do not pass the parts-inspection department, the tool inspection department is held responsible, and is expected to locate the trouble as well as to suggest some means for remedying it.

Blanking and drawing dies are inspected by the tool inspection department for dimensions. They are then sent to the press department for trial. The first parts turned out by the dies are then sent back to the tool inspection department as a final check of the die. These parts are tagged and kept by the inspection department for reference. Lead proofs are made of all drop-forging dies, and these are also kept by the tool inspection department for future reference. The first actual forgings made by a drop-forging die are also sent to the tool inspection department in order to ascertain that they conform to the lead proof, and are kept for future reference.

In the inspection of taps and threading dies, an actual trial is made of a few taps and dies to see that they cut properly. The lead is inspected by an Alfred Herbert thread testing machine. The tool inspection department is also responsible for gages of all kinds used in the factory, and in order to maintain the quality of gages, a special method known as "night tool inspection" is used.

Night Tool Inspection

A tool inspector visits the various manufacturing departments after the closing hours and inspects all the gages used during the day. These gages are left out by the supply keeper so that the night inspector knows what gages have been used, and in that way is enabled to maintain the gage equipment in a first-class condition. Some departments are visited only every other night, while the grinding department is visited every night on account of the fact that the gages there usually have smaller tolerances and wear faster. This night inspection saves a great deal of poor work, and eliminates arguments with the men that their gages are incorrect; thus it not only increases production, but also creates a better spirit in the plant.

Every gage below size is returned to the tool department and replaced. By checking the gages in this manner, time is spent only on inspecting the gages that are actually in use, but these are checked frequently. Systems that include going over all gages at certain intervals involve a checking and rechecking of gages that may not have been in use at all, while those that are used daily are not inspected often enough to maintain the required accuracy. As one man inspects all the gages throughout the plant, there is no divided responsibility; and such gages as adjustable thread gages, etc., are sealed with sealing wax in order to protect both the inspector and the man who uses them.

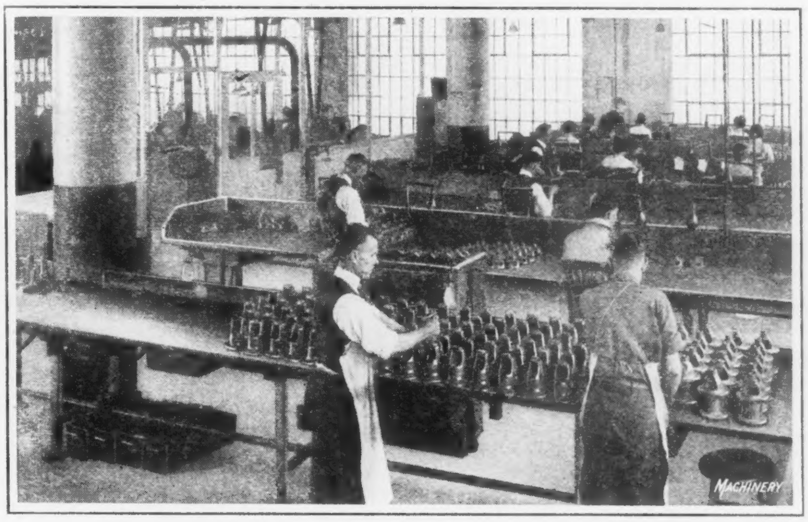


Fig. 2. An Inspection Department for Finished Parts

Equipment of the Tool Inspection Department

The tool inspection department is provided with the necessary equipment of Pratt & Whitney and Johansson precision blocks, Hirth minimeters, American amplifying gages, standard thread plugs and receivers, Alfred Herbert lead-testing machine, Hartness screw thread comparator, together with a full equipment of the more usual types of measuring instruments.

A number of sets of precision blocks are used. One set is kept as a master reference set. This set has been verified by the Bureau of Standards, and all new sets received are checked against it. The several sets of precision blocks in use in the plant are checked about once a month against this master set. If some of the blocks are found to have worn, the amount that they are below size is marked on the lid of the box in which they are kept, immediately above the block, so that by taking this figure into account the blocks can still be used for precision purposes. The best set next to the master set is kept in the tool inspection department, and as new sets are acquired, this set, with the wear marked upon each block, if wear has taken place, is passed on to the various other departments that use precision blocks.

All ground work is inspected by Hirth minimeters or American amplifying gages. Setting blocks of accurate dimensions are made in the tool-room for each part to be inspected by this type of gage. The tool inspection department works entirely to definite standards and limits which are arrived at in the application of the limit system. The tolerances are predetermined, and are specifically incorporated in the tool drawings or in the drawings for the parts to be made with the tools.

Under the high productive pressure system used in the Delco plant, the life of a gage is rather indefinite and is governed by many conditions. Therefore, unless the gages are always kept in a first-class condition there is always a possibility of spoiled work. For this reason the night inspector, in addition to returning such gages as are under size to the tool supply room, makes out a daily report covering the entire inspection, and in this way the limit system is rigidly maintained.

Inspection During Manufacture

The method of conducting the inspection of material as it moves through the shop varies greatly with the requirements in different plants. The detail of inspection and the accuracy necessary in producing electrical automobile equipment is, of necessity, much greater than it would be in the manufacture of, say, dredging machinery. There are in general use two principal methods of conducting inspection of parts during manufacture—traveling or floor inspection, and centralized inspection.

Comparison of Floor Inspection and Centralized Inspection

Under the first method—floor inspection—the inspector spends all his time on the shop or factory floor, moving from place to place as necessary. The initial parts are checked as they come from the machines, and the finished lots checked as regards both quality and quantity when they leave or arrive at each new operation or process.

In the centralized method of inspection, central inspection rooms are provided, and all work is returned to the proper room after each operation or after a definite number of operations. This method is of considerable advantage when the parts are small and the limits of accuracy close. If, however, the work is large and the parts heavy, it is obviously impractical. The extent to which one or the other or the combination of both of these systems should be used is a problem of management which often requires very good judgment. In general, if the parts are small, and the work of transferring them is not great, centralized inspection will be cheaper and more effective.

The experience which the Delco plant has had with floor inspection has proved that the placing of floor or traveling inspection in a department tends to relieve the foreman of the department of the responsibility for the quality of the work. Floor inspection does not necessarily insure quality. Quality product can only be obtained by the operator. The foreman of a department must assume the responsibility for the operator's turning out accurate parts.

Departmental Inspection Versus Centralized Inspection

Completely centralized inspection usually involves a considerable amount of extra handling. Then, too, under completely centralized inspection, without floor inspection, there is the added possibility of defective work in considerable quantity. For example, some of the Delco parts have as many as thirty operations conducted in a half dozen departments. If such parts were carried entirely through these operations without intermediate inspection, there would be a possibility of great financial loss. The operation on which

such a piece was spoiled might be among the first, with the result that all succeeding operations would be performed on a defective part. Departmental inspection results in the inspection of the work after each department has finished its operations. In this manner, defective work is discovered before the cost of subsequent operations is added.

The department inspection is carried out in the manufacturing departments, each inspection department being under the charge of an inspection foreman or job foreman, responsible to the general inspection foreman, who, in turn, reports to the chief inspector. Two of the parts-inspection departments are shown in Figs. 1 and 2.

Parts in Process Inspection

The methods used in the various departments for inspecting parts in process differ with the nature of the parts being inspected. Small parts from automatic and hand screw machines, such as screws, nuts, and bushings, are generally inspected by picking up 10 per cent of the number of pieces from a lot and giving these a thorough inspection with thread, plug, and receiver gages. If any of these parts are found to be defective, the whole lot is inspected. The inspector is also held responsible for the accurate count of the pieces. If any parts are held to very close limits and there are a number of operations following, every part is inspected. After the inspection the parts pass on to the next operation.

The inspection of power press parts on which drawing and forming operations have been performed requires that every part be inspected, using special inspection fixtures. Blank parts are ordinarily inspected for the proper dimensions according to the specifications given on the blueprint, such items as diameter, location of holes, etc., being checked.

Fig. 3. A View in the Final Inspection Department, showing Soundproof Booths to the Left

Ground and hardened parts are given a much closer inspection. In addition to plug and snap gage inspection, indicator gages—especially amplifying gages—are used, and scleroscope and file tests are made. A number of special fixtures are also employed, some of which will be illustrated and described in a coming article in MACHINERY.

Molded insulation parts are given an electrical test, in addition to the visual inspection for molding defects. In the inspection of gears, the inspection department makes actual running tests from the first samples turned out, on a machine after it has been set up for quantity production. The approval of the inspection department must be secured before further gears are cut by the operator. After heat-treatment, all parts are tested to ascertain whether they have warped. The scleroscope is freely used for hardness tests. All plated and enameled parts are also inspected after heat-treatment. On all parts where concentricity is important or where for some other reason it is necessary to determine that the part will finish properly in a subsequent machining operation, such inspection is made. It is evident that this part of the inspection as well as inspection of locating points for subsequent operations is of great importance. Each inspector is held responsible for the finished dimensions in each operation. When the part is passed through its last operation and has been approved by the inspection department, it finally passes to the stock-room from which it is drawn by the assembly department.

The manufacturing departments in the Delco plant that are provided with parts-inspection departments are the drilling and milling departments, the hand screw machine department, the gear and lathe department, the automatic screw machine department, the plating department, the insulation department, and the armature department.

Sub-assembly Inspection

The apparatus made by the Delco plant is largely built on the unit plan, making possible sub-assemblies which can be returned to the stock-room and drawn from there for the final assembling work. After the sub-assembly has been completed, there is an inspection of the assembled unit to determine that the proper parts have been used in the assembly, that no damage has been done to the parts during the assembly work, and that the parts have been properly put together. Then the assembled unit goes back to the stock-room.

Final Inspection

In practically all industries a final examination is made of the finished product before shipment. These final inspections and tests are usually conducted in accordance with instructions furnished by the engineering department. The requirements of the final test are often set by the purchaser, and he or his representative may be present at the test. It is generally the practice, in highly specialized manufacturing plants having functionalized inspection, for the engineering department to prepare complete data sheets covering the final inspection and test. This practice is carried out in the plant of the Dayton Engineering Laboratories Co. The final inspection of the product in this organization may be divided into two definite phases—first, mechanical inspection, and second, electrical inspection.

Final Mechanical Inspection

The final mechanical inspection is performed as close to the assembly operation as possible, permitting defects to be taken care of immediately by the builder or the repairman. Inspectors must see that the parts are properly assembled, correct parts used—free from defects—and must also inspect for quality and workmanship.

Each piece of apparatus is numbered in series, the number being stamped on the apparatus. The assembler places a tag with a corresponding serial number on each motor or generator at the time the building operations are started. By this method the motor car companies keep a record of the serial number of the apparatus installed on each car. A space is provided on the tag for the inspector to place his check number when he has approved the inspection of the apparatus.

Preliminary electrical tests are made by the mechanical inspector before the apparatus is sent to final electrical inspection for final electrical test. Mechanical inspection is carried out through the various stages of assembling to insure quality product.

Final Electrical Inspection

The final electrical inspection of completed apparatus is made after the product has been passed by the mechanical inspectors. All motors and motor generators are subjected to a one-half hour running test as a motor for the purpose of thoroughly heating them. This test also serves to bring out "grounds" or "shorts," as well as faulty connections, and to properly seat the brushes. On this running test the motors are subject to inspection for the amount of current consumed. From this test they are transferred to a torque test, and the amount of "stalling torque" determined. Definite limits are established by the engineering branch when the product is designed, to meet the requirements of the customer.

Generators are taken from the running test, placed in soundproof booths, and tested for generating capacity, noise and electrical defects. A row of these booths is shown to the left in Fig. 3, and an inside view of a testing booth in Fig. 4. Here again the inspector is made responsible for the approval of the apparatus, by the recording of his check number on the serial tag. Incidentally, he also checks the stamped number on the apparatus against the serial number on the tag to see that they agree. To insure that no electrical defects have been overlooked during these two tests, and that no "grounds" are caused in fitting the covers, a third electrical inspection is made after the apparatus leaves the test booth. This test is made by the use of "test points" on a 110-volt line, after the "end and dust-cover fitting" operation.

The final electrical inspection of distributors is accomplished by the use of special test fixtures. Automatic spark advance, variation in degrees between sparks, strength of spark on each cam lobe, and the number of degrees of hand advance (to meet definite established limits), are among the salient features of the testing. A departmental foreman is in charge of each of the two phases of final inspection, and a general foreman is in charge of all final inspection functions. The general foreman is directly responsible to the chief inspector.

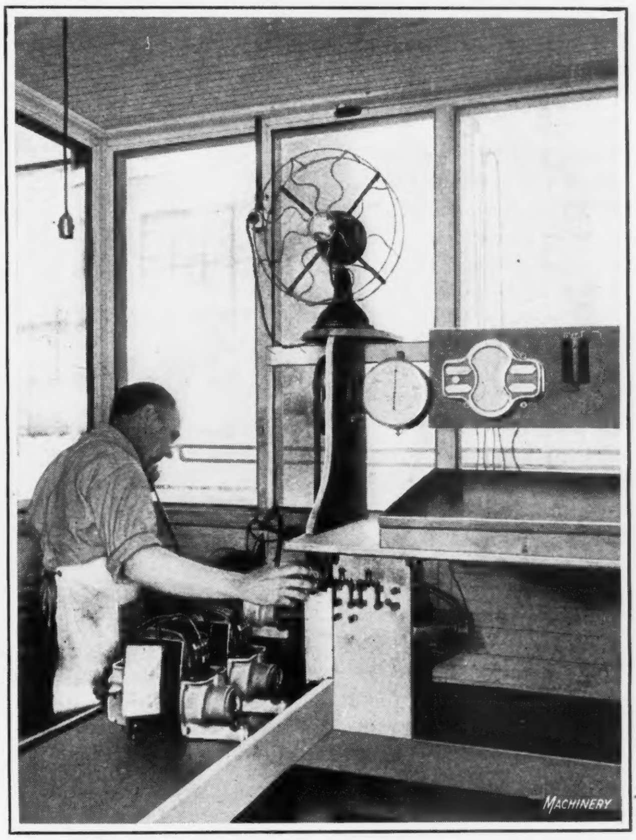


Fig. 4. Inside of a Soundproof Inspection Booth, where Apparatus is inspected for Silent Running

Road Inspection

It is the policy of the Delco organization to assign high-grade inspectors to the various automobile districts, and even, in some cases, directly to customer's plants, for the purpose of keeping the factory in close touch with any trouble that may develop after the shipment of the apparatus from the factory. In this way minor defects which may be overlooked in the factory are caught and remedied before the apparatus actually goes into service. This inspection service is of great importance. It produces a close contact between the manufacturer and his customer; it aids in having the apparatus built by the Delco plant properly used; and, as the Delco products are part of the customer's final products, it is of importance to the Delco organization that its product be placed properly in the ultimate product of the customer.

Service Inspection

The contact of the inspection organization with the product does not end here. As soon as a car is shipped from the automobile manufacturer's plant the question of service becomes paramount. The service division of the Delco organization is almost a complete unit in itself, operating under the general supervision of the sales department. All defective apparatus returned from service is handled by the service division. As soon as a piece of defective apparatus is returned, it is carefully inspected. At this point the service inspection department, which is a part of the inspection organization, begins to function.

Service inspection includes practically every type of inspection previously described. Every "ailment" known to electrical apparatus is eventually diagnosed by this department. This fact is of particular significance to the inspection organization as well as to the manufacturing organization. From the service records and from the inspection records of material returned from service, much information is gained which is of great importance in designing new apparatus, setting manufacturing limits, and arriving at proper standards of quality. This service inspection department is the final or connecting "arc" in the inspection "circle," forming a complete ring of responsibility, authority, and information.

The Salvage Department

Spoiled work and waste materials constitute one of the greatest leaks of direct financial loss in many manufacturing plants. Recently a great deal of attention has been paid to the matter of waste, and the results accomplished by a well-organized salvage department have been remarkable in a number of cases.

Spoiled work is not always a complete loss. Sometimes repairs may be made or the material reoperated. The function of the salvage inspection department, as will be described later, is to determine if spoiled work is subject to economical salvage. Material consigned as scrap is sent to the salvage department. The necessary records for material of this class are kept on what are known as scrap and reoperation tickets.

In many classes of work there is a certain amount of unavoidable scrap or waste, not from spoiled work, but resulting from the regular processes. For example, in metal-stamping operations, there will be quantities of blanking scrap left over; scrap in the form of turnings and borings is left from other classes of work, and so on. The amount of this scrap affects the cost of the work. When the scrap is high, the cost will naturally be higher. All such scrap is carefully collected and sold, as the scrap value bears an important relation to the total cost of manufacture.

All scrap and waste material must be sent to the salvage department. Here it is graded according to classification and held for sale. Common salvage, such as metal press scrap, turnings, borings, and similar material, is gathered and placed in separate containers and bins and shipped on sales contracts.

The salvage department is the "bone-yard" of the factory. Nothing in the way of waste material is overlooked. Files are recut; belting relaundered; screwdrivers, monkey-wrenches, hammers, pliers, and the like are repaired; milling cutters, reamers, and drills are salvaged by recutting or using the tool steel for other purposes; high-speed reamers, drills, and cutters are reduced to smaller sizes; lumber in the form of barrels, boxes, magnet wire spools, etc., is salvaged; obsolete machinery and tool supplies and machine appliances are sold. Salvage material is not permitted to leave the factory without the approval of the salvage department.

Salvage Inspection Department

The salvage inspection department and the salvage department are operated under separate heads, the first-named being responsible to the general inspection foreman of parts in process. The functions of the two departments are different; the salvage inspection department merely passes upon material rejected by the various departmental inspectors for the purpose of determining whether the material can be reoperated or will be scrapped. If scrapped, it is turned over to the salvage department which disposes of the material at its scrap value, as explained in the previous paragraphs.

The parts that must definitely be scrapped are passed on to the salvage department. For such parts the inspection department makes out a scrap ticket, which is signed by the foreman of the department whenever any material from his department is to be scrapped. This method gives the foreman information as to what material from his department has been found defective, and gives him an opportunity to remedy the defect immediately.

Central Inspection Office

In keeping with the functional plan in inspection, all clerical work in the inspection division is handled through the central inspection office. This plan enables the routine of the various inspection departments to be closely coordinated with the general inspection system.

* * *

CUTTING RATCHET TEETH ON A DRILLING MACHINE

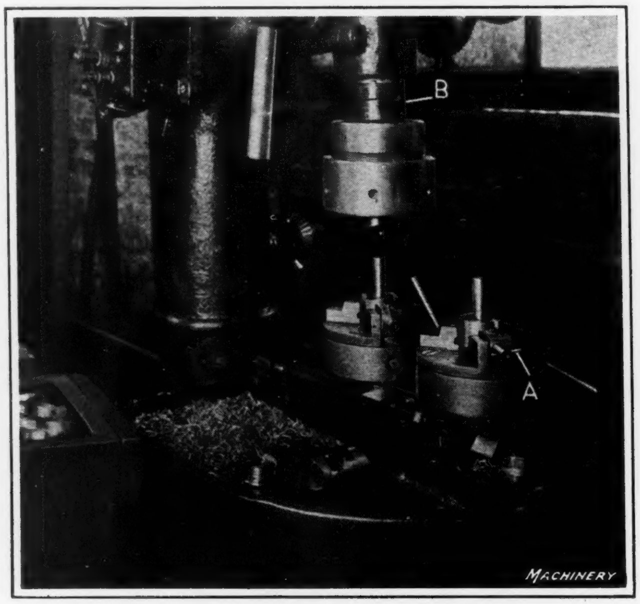
In the machine shop of the De Laval Separator Co. at Poughkeepsie, N. Y., a drilling machine is equipped for machining ratchet teeth in small steel collars, as shown in the illustration. These collars are first slotted to the depth of the teeth to form the front angle of the teeth and to provide a clearance space for the tool used in finishing the teeth on the drilling machine. A special tool of the counterbore type is used for this purpose, both ends being provided with cutting teeth, as may be seen by referring to the illustration, where one of the tools may be seen lying on the table of the machine.

The tool is held in the chuck by means of four set-screws which engage counterbored spots on opposite sides of the tool. Two spots on each side are machined in a direction nearly tangential to the circumference of the tool but in opposite directions, so that the screws in each pair operate against each other and make it impossible for the tool to become loosened during the severe service to which it is subjected.

The collars are clamped in a two-station fixture which is clamped to the table of the machine and which has a slide in the base, with suitable stops, in which a dovetail in the upper portion of the fixture operates. In this way, one piece is being removed and the station reloaded during the time required to machine the work held in the other station. It will be clearly seen that the chucks which clamp the work in place are provided with a pilot which engages the hole in the tool during the machining operation, thus holding the tool and the work in perfect alignment. It will further be observed that a pilot screw *A* is employed for the purpose of locating the work so that the cutting edges of the tool will be in the proper relation to the slots previously machined in the collars; the angle of the teeth must run into the slot at the correct depth.

The attachments provided for performing the work are as follows: A heavy coil spring is interposed on the top of the spindle between a collar and the top bearing. The spindle also carries two pairs of mating ratchet-teeth cams, which are made of hardened tool steel. One of these pairs of cams is located just above the machine spindle sleeve, and one just below it. The lower pair may be seen at *B*, but the upper pair and the recoil spring do not appear in the illustration. It will readily be understood that the action produced by this arrangement, when the feed is in engagement, is a jerky, intermittent motion, which is caused by the ratchet-cams gouging the cutter into the metal an amount determined by the rate of feed, and by the quick-return movement produced by the stiff coil spring at the top of the spindle.

Two sets of cams are employed, so that by placing them in a certain relation to each other, the harshness of the upward motion of the spindle will be lessened somewhat by breaking the force of impact between the engaging teeth of the cams. This is an unusual method of performing an operation of this kind, but nevertheless an effective one, for a high production rate is obtained by the use of the equipment described.



Drilling Machine with Special Provision for cutting Ratchet Teeth in Steel Collars

* * *

RIVET CUTTING RECORD

What is believed to be the record for cutting rivets in the dismembering of steel freight cars was recently established by an operator who cut out 1038 rivets in two hours and forty-six minutes. Of this number 683 were 5/8-inch rivets, 228 were 3/4-inch rivets, and 127 were 7/8-inch rivets. The cutting was done on a standard Erie car under general yard conditions, the operator taking the rivets as they came, working inside, outside, and under the car. The car was one that had been retired from active service and that was in the car shop for repair, the rivets and plates being covered with heavy scale and rust, thereby rendering the cutting very difficult. It is said that the record applies not only to the number of rivets cut in the time mentioned, but also to the low consumption of gases used, the job taking only 384 cubic feet of oxygen and 83 cubic feet of acetylene. The operator used an "Oxweld" cutting blowpipe with a rivet-cutting nozzle.

Selling Machine Tools

First of a Series of Articles on the Work of the Machine Tool Salesman, Duties of the Selling Force, and Policies in Selling Machine Tools

By HOWARD W. DUNBAR, Sales Manager, Grinding Machine Division, Norton Co., Worcester, Mass.

FROM the rough casting to the production department of a customer's plant is a long journey beset with engineering, sales, transportation, and financial difficulties, which must be met and overcome by every successful builder of machine tools.

The salesman expects others to design, produce, and arrange for the transportation of the machines he sells; and he is not ordinarily expected to be the sole judge of the financial rating of the customer. However, there are certain sales policies that must be adopted by every organization and that must be carried out in a manner that will promote the greatest possible degree of harmony with other functions of the organization, in order to promote the interests of the company that the salesman represents.

Primary Duty of a Machine Tool Salesman

Salesmen of machine tools are expected to sell engineering principles first. When the prospective customer is properly impressed by the fundamental facts in connection with the value of the machines offered, it will be found that the selling price is not the main factor in which he is interested. There are a number of fundamental principles underlying the value of machine tools as a means for increased production, which vary according to the nature of the machines. In some machines these principles may relate to the feeds and speeds, in others to the accuracy with which they perform their work, and in still others to the extreme power and capacity for metal cutting that they possess. In all machine tools rigidity and properly distributed weight are essential features. The principles applying to each class of machine tools should be properly defined, and the diligent support of these principles is essential to the success of every salesman. Adherence to these principles and the education of the trade to appreciate them should be the primary sales policy of every machine tool builder.

Suggestions for Modified Design

Prospective customers of machine tools frequently indicate changes of design that they believe to be desirable for their particular needs. Except in comparatively rare instances these modifications are not based upon real necessity, and are often due to misconception of some fundamental principle relating to the best and proper use of machine tools. Every case of this kind should be made the occasion for a tactful lesson in the principles involved in the design and use of machine tools. The salesman has an opportunity to emphasize the use, the mechanical simplicity, and the indispensable character of each mechanism that has been incorporated in the machine that he sells through years of experience in the design of a certain line of machine tools.

Suggestions for Special Fixtures

Lathe and planer builders are not generally expected and rarely asked to make jigs or fixtures to hold the work on their machines, but buyers of turret lathes, milling machines, and grinding machines, for example, frequently require the manufacturer to design and build special holding devices. In some lines of machine tool building, the making of such holding devices becomes part of the equipment of the machine, and some manufacturers make a point of encouraging the ordering of equipment of this kind with their machines. As a rule, however, the building of such additional equipment is not profitable. The larger machine tool shops, especially, are equipped and tooled for the production of a definite line of machine tools. The building of special fixtures and attachments delays production and involves costs that always seem excessive to the customer. The salesmen of many machine organizations, therefore, encourage the customer to build his own fixtures. When he does, he usually views the cost on the basis of material and labor alone, and it is the opinion formed on that basis that makes the price asked by the machine tool manufacturer seem high to him, as, of course, the machine tool builder must always include overhead and a reasonable profit.

The question of special equipment must be dealt with individually by each machine tool builder. In some cases it becomes absolutely necessary that he equip his machine with the attachments or fixtures that will make it perform the work for which it is intended, at the most rapid rate. In other cases, it is obviously advantageous for the customers own tool department to design and make the required fixtures. A definite sales policy in this respect should be adopted by each manufacturer according to his own needs. Every manufacturer is always ready to suggest the methods that ought to be used and the general design of the holding device, and make sketches of special equipment for handling unusual shapes.

In order to facilitate the work of designing special fixtures on the part of the customer, machine tool builders should be prepared to furnish dimensioned drawings and cross-sections of tables, spindle noses, etc., to which the special equipment must be fitted. In many instances, the buyer of machine tools would probably find that he could obtain cheaper service in the case of special jigs and fixtures, from the tool job shops than he does from the machine tool builder; and the machine tool builder will also profit by having this trade taken over by a specialist, because the building of special equipment in a shop organized for regular production is generally a costly and unprofitable business.

Returning Machines to the Factory for Repairs

The practice of returning machines to the factory for repairs is not recommended. In fact, it has almost invariably been found cheaper to scrap the old and buy new. That this also holds true with attachments is indicated by experience. When an old machine is received for overhauling, a high-grade mechanic must be assigned to the work of tearing down and examining it in order to decide what parts need to be repaired, what replaced, and what retained without change. Add to this man's time the cost of repairs, replacements, and reassembly, and the reason for discouraging this practice becomes evident. Occasional exceptions to the above are sometimes necessary, and therefore due consideration must be given the facts of each case.

Credit Allowance on Returned Parts and Material

Customers frequently return parts of machines for repairs or credit. The returning of parts and mechanisms for credit should be firmly discouraged. Sometimes the parts returned

are not worth repairing and should be replaced, or the parts returned for credit are either obsolete, in poor condition, or incomplete, and may require considerable expense to put them in salable condition. Under the general system now in use by most machine tool builders, of specifying equipment for machines, there will be fewer cases where it is necessary to return parts and mechanisms for credit; but even though they are more rare, there will always be occasions when a customer has parts or attachments which he wishes to return. A definite policy should therefore be adopted to cover all usual circumstances. These rules must be applied with judgment, and with regard for any special features in each individual case.

At inventory time, there is a tendency for customers to attempt to return material in order to effect a transfer of goods from their shelves to the manufacturer's. When it is evident that this is being done, machine tool manufacturers should not accept returned material, especially if the parts returned have been in the customer's plant for over, say, three months. A general rule, of course, would work an injustice in certain cases, and therefore it is not possible for any manufacturer to make a definite ruling, but, in general, a three month's restriction would relieve the machine tool builder of the responsibility of allowing credit for parts which, while ordered in good faith, should be charged by the customer to his own inventory rather than asking the machine tool builder to carry the burden.

The Making of Repairs

Every machine tool builder should have some kind of system for handling repairs on his customers' machines. A good plan is to have every job that comes for repairs inspected and a report made by the shop, estimating the time required and being accompanied by a list of new parts necessary for the repairs. The sales department could then decide whether it would be cheaper to repair or to replace, and could advise the customer as to the best method of procedure, stating approximate costs in each case. The good will obtained from the customer when he realizes that in each case a careful estimate is made as to which method will be cheapest for him is of great value.

Procedure in Allowing Credit for Returned Parts

Machine tool manufacturers should have a definite system for allowing credits on returned parts so that their salesmen may know definitely what to promise in each case. When parts are returned for credit, they should be inspected in the shop and a report made on the conditions of the parts, stating whether they are in condition to be returned directly to the stock-rooms, and if not, reporting in detail whether they are to be scrapped; or if repairs or painting are required, giving an estimate of the time and material necessary to put them in a salable condition. This information should be furnished to the sales department, which could then advise the customer as to the credit that will be allowed for the parts returned. Such a system is necessary in order that the customers will be dealt with alike in every case.

Each machine tool builder must, of course, determine for himself the basis for credit allowances. Generally speaking, a reasonable basis for such allowances would be as follows:

Material returned because of the builder's error should be credited at full selling price, and the builder should pay transportation charges.

Material returned because of customer's errors in ordering, new parts being ordered to replace those returned because of a change in his manufacturing plans and needs, should be credited at full selling price, the customer to pay transportation charges.

Material returned because of customer's error in ordering, no new parts being ordered to replace those returned, should be credited at a predetermined credit price, the customer to pay transportation charges.

When orders are changed before shipment, other parts of machines being substituted, full credit should be allowed on standard equipment. On special equipment credit should not be given, nor should special equipment be accepted if returned for credit.

When equipment is returned that requires labor or repairs, it should be credited at the current credit price less the actual cost for repairs. The credit price would naturally vary with different manufacturers. A fair credit price would probably be two-thirds the selling price.

Salesmen's Handling of Complaints

It is not unnatural for the sales force, hearing only one side of the question, to agree with the customer, particularly when complaints are presented. When a customer complains to a salesman of poor workmanship, the easy but fatal course to take is to admit faulty workmanship without investigation, or, by advancing an apologetic defense, to imply that such workmanship may be easily possible. There is no more certain way for a salesman to lose the good opinion that his customer has of him and the machines that he is selling than to allow the customer to think that the salesman believes it possible or probable that when the complaint is investigated it will be shown to be founded on serious defects.

A salesman representing a machine tool builder who is known to do his utmost to produce first-class machines and equipment need not take the position that it is likely that a defect is present. He can afford to act constructively by treating each criticism of the machines or policies of the organization that he represents as a reflection on an organization that is not permitting anything defective to pass out of its plant. If a salesman cannot have such faith in the organization that he represents, he will not make a good salesman. If he is to put his whole heart in his work, he must create within himself a loyalty to his company that will arise to rebut every criticism in the same way as he would spring to the defense of the character of a member of his family.

To achieve this attitude, the firm that the salesman represents must have established a reputation for not countenancing poor workmanship and for building machines that will produce as well as or better than any other machines on the market; but this reputation must be coupled with the knowledge that when a part is found actually defective, the builder wants to know it at once so that he may rectify an error as quickly as possible. When the salesman has impressed himself with these things he will become willing and fit to uphold them, and he will find in his customer's manner a new respect for his views.

Every machine tool builder should have a regular system by which complaints are handled, and should encourage salesmen to send in reports regarding every direct or indirect complaint that may be made against his machines. These complaints should be taken up at regular meetings of the executive members of the sales, designing, and shop departments. The men composing such a committee would be able to make authoritative decisions, and it could be expected that when a complaint has been submitted and acted upon, the decision would be accepted by all departments without reservation. Briefly stated, a salesman's duty should be to report every complaint which he hears, but his attitude toward the customer must indicate that he feels confident in his machine and that justifiable complaints are rare, but that, if the manufacturer has made a real error, he is anxious to rectify it.

* * *

There are now, according to *Safety Engineering*, 900 industrial plants in the United States employing a total of about 1500 physicians, either part or full time. It has been found that an efficient medical department insures a healthy force of workmen and results in increased production.

ODONTOGRAPH FOR LAYING OUT 20-DEGREE GEAR TEETH

By J. L. WILLIAMSON

The increasing demand for more compact electric motor units for railway service has resulted in the use of 20-degree involute gears for this class of work. The change from the commonly employed 14½-degree tooth to the 20-degree tooth makes it possible to reduce the center-to-center distance between the pinion and gear and still maintain the required strength. In order to show more clearly the advantages of the 20-degree tooth for this class of work, let it be assumed that a 14½-degree pinion-and-gear drive has been installed and that it must be replaced by new gearing, as the teeth have not proved strong enough to carry the load.

The usual method of overcoming a difficulty of this kind would be to decrease the diametral pitch of the new gears in order to provide coarser teeth, but as the speed ratio between the gears must be maintained, and the center distance between the pinion and gear cannot be increased, it becomes evident that greater strength can be obtained only by changing the form of the teeth. Thickening the tooth at its weak point by the employment of a greater pressure angle in laying out the tooth profile therefore becomes the best means of overcoming the difficulty.

Having had occasion to make several lay-outs for 20-degree teeth and being unable to obtain an odontograph similar to Grant's odontograph for 14½-degree teeth, the writer has calculated the constants given in the accompanying table, which may be of use to others confronted with a similar problem. For gears having more than 37 teeth the approximate radius of the arc forming the tooth profile can be obtained by the formula

$$\frac{20\pi N \cos 20 \text{ deg.}}{360P} = \frac{0.164N}{P}$$

in which N equals the number of teeth and P the diametral pitch. The following example will illustrate the use of the table: Let it be required to make a lay-out of the teeth for a gear and pinion having 71 teeth and 16 teeth, respectively, of 3 diametral pitch, with a pressure angle of 20 degrees. Referring to the accompanying diagram, the profile of the pinion tooth may be considered as two arcs generated by

ODONTOGRAPH FOR 20-DEGREE INVOLUTE GEAR TEETH OF BROWN & SHARPE STANDARD PROPORTIONS

No. of Teeth in Gear	Face Radius R	Flank Radius r	No. of Teeth in Gear	Face Radius R	Flank Radius r
12	2.952	0.984	25	5.084	3.116
13	3.155	1.109	26	5.202	3.326
14	3.352	1.240	27	5.310	3.546
15	3.543	1.377	28	5.419	3.766
16	3.726	1.522	29	5.520	3.999
17	3.903	1.673	30	5.609	4.231
18	4.074	1.830	31	5.691	4.477
19	4.238	1.994	32	5.772	4.723
20	4.395	2.165	33	5.841	4.983
21	4.546	2.342	34	5.911	5.242
22	4.690	2.525	35	5.967	5.514
23	4.828	2.716	36	6.022	5.786
24	4.960	2.913	37	6.068	6.068

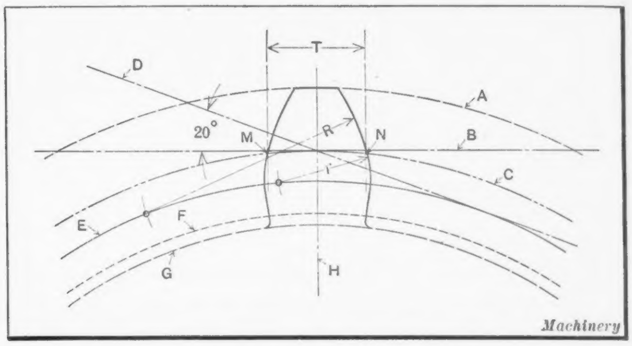
Machinery

the face radius R and the flank radius r. The arc generated by radius R forms that part of the tooth outline lying between pitch circle C and the top of the tooth, while the arc generated by flank radius r forms that part of the tooth outline between the pitch circle C and the base circle E. These radii are obtained by dividing the constants in the table opposite 16 in the column headed No. of Teeth in Gear, by the diametral pitch, which in this case is 3. Therefore the face radius R of the pinion equals 3.726 divided by 3 or 1.242 inches, and the flank radius r is equal to 1.522 divided by 3 or 0.507 inch. These arcs are drawn about centers located on the base circle in such a position that either arc is a continuation of the other.

The profile of the 71-tooth gear may be considered as an arc of a circle, the radius of which is obtained by dividing 0.164×71 by 3 which equals 3.881. With a radius of 3.881 (3⅞ inches) draw the arc which forms the tooth profile about a center located on the base or generating circle.

Laying out Tooth Profile

The exact procedure in laying out the gear tooth profile for the 16-tooth pinion would be as follows: First calculate the pitch diameter, outside diameter, whole depth of tooth, clearance, and thickness of tooth on pitch circle C. To find



Method of laying out 20-degree Gear Teeth

the pitch diameter, divide the number of teeth by the diametral pitch. To find the outside diameter, add 2 to the number of teeth and divide the sum by the diametral pitch. The whole depth of tooth is found by dividing 2.151 by the diametral pitch. To find the clearance, divide 0.157 by the diametral pitch. The chordal thickness T of the tooth is obtained by the formula

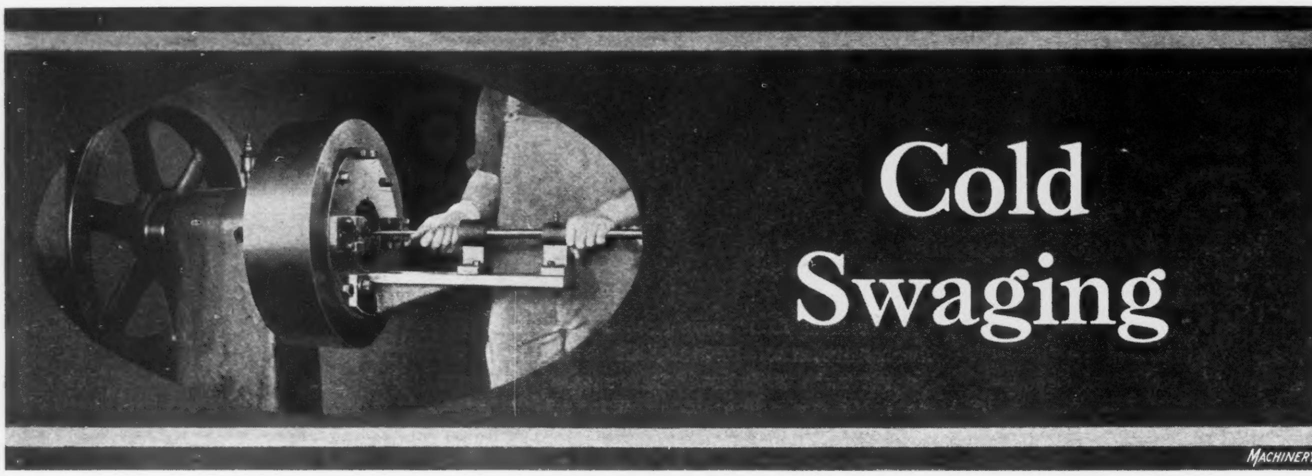
$$T = \sin \frac{90}{N} \times \frac{N}{P}$$

in which N equals the number of teeth and P the diametral pitch.

Now draw a vertical center line H, and with a compass set to a radius equal to half the pitch diameter draw pitch circle C about a center located on H. A section of this circle is shown in the accompanying diagram. Then from the same center and with a radius equal to one-half the outside diameter draw circle A. With a radius equal to the difference between the radius of circle A and the whole depth of tooth, draw circle G, also from the same center. Now with a radius equal to the radius of circle G plus the clearance draw circle F. Next at the point of intersection of center line H with the pitch circle draw line B at right angles to H. Line D is then drawn at an angle of 20 degrees with line B as shown. Now from the common center of circles A, C, F, and G, draw circle E tangent to D. This circle is known as the base or generating circle. Next draw two lines parallel with, and equally distant from line H, and a distance apart equal to T. These two lines intersect pitch circle C at points M and N. Now with N as a center and a radius equal to R strike an arc which intersects base circle E. From this point of intersection and with the same radius draw an arc from N to circle A as shown. Then with r as a radius, draw the arc which forms that section of the tooth profile lying between pitch circle C and base circle E. Complete the portion of the tooth profile lying between circles E and F by drawing a radial line from the common center of arcs A, C, and G. The small fillet or arc at the root of the tooth can then be drawn in, thus completing the tooth profile.

* * *

During 1920, 1325 airplanes from the Continent landed passengers and freight in Great Britain. They included 1079 British machines, 236 French planes, 9 Belgian and 1 Swiss.



Cold Swaging

Application of the Swaging Process and its Effect on the Quality of Metal—Based upon the Experience of the Torrington Co., Torrington, Conn.—First of Two Articles

By FRED R. DANIELS

THERE are certain mechanical operations that cannot be performed by any other method than swaging—the uniform rapid hammering of metal by means of a swaging machine for reducing the sectional area of the work. Swaging is used for work having a circular cross-sectional area, and metal cannot be swaged by a swaging machine into any other sectional shape. For that reason a great deal of the work usually produced by the swaging method consists of small wire parts, sewing needles, instruments, and instrument parts. Another application of the swaging process is in tapering and reducing the diameter of tubing.

While swaging is the only method that can be employed for a large variety of work, it should be understood that the swaging machine is not intended to compete with the automatic screw machine on such classes of work as can be economically produced on these machines. There is a large class of work that cannot be economically done by swaging, and it is as important to understand the limitations of the process as its broad applicability.

While it is true that there are decided limitations to the use of the swaging process, it has been found, on the other hand, that practically every known metal can be successfully swaged, including not only steel bars and wire, copper and brass, but also such materials as tungsten and monel metal. The latter material, which is composed mainly of nickel and copper, has caused, perhaps, the most difficulty of any in securing satisfactory results with this process.

The Swaging Machine and its Principle of Operation

The mechanical principles involved in the Dayton swaging machine, built by the Torrington Co., Torrington, Conn., are the same as those incorporated in other types of swaging machines, and there has been no material change in the principle governing its operation within recent years. Essentially the machine consists of a roll rack *A*, Fig. 1 in which a number of hardened steel rolls are free to rotate. The end of the machine spindle contains a diametral slot in which the dies *B* and the backers, the rounded end of one of which is shown at *C*, are carried. As the spindle revolves, these backers are brought into successive contact with the rolls, which results in closing the dies each time the two backers and a pair of rolls come into contact. The spindle revolves at a speed of from 200 to 600 revolutions per minute, depending upon the size of the machine; hence it will readily be seen that the spindle speed is multiplied by the number of rolls carried in the rack, in order to obtain the number of blows transmitted to the work per minute. In the case of the machine shown in Fig. 1, it will be seen that there would be an average of 3600 quick, short blows, or more correctly, applied pressures, delivered to the work each minute, assuming a spindle speed of 300 revolutions per minute. The machine spindle has a central hole passing through it, so that provision is made for stock to be fed from a coil in front through to a coil at the rear of the machine, if the nature of the work will permit this to be done. Since the roll rack is a floating member, it will

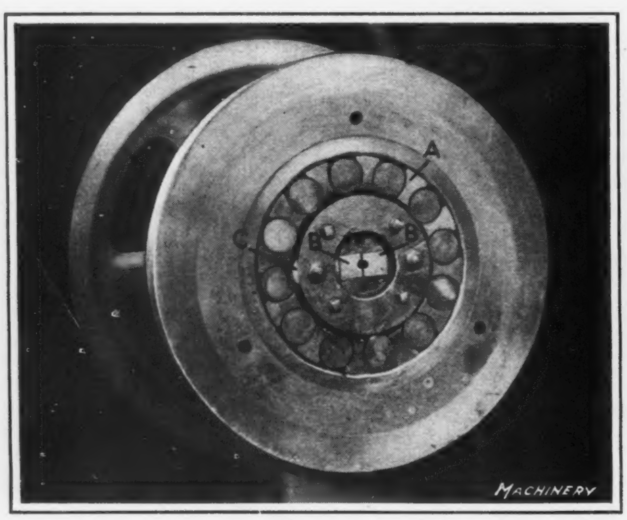


Fig. 1. Swaging Machine with Cover Plate removed, showing Dies, Backers, Rolls, and Roll Plate

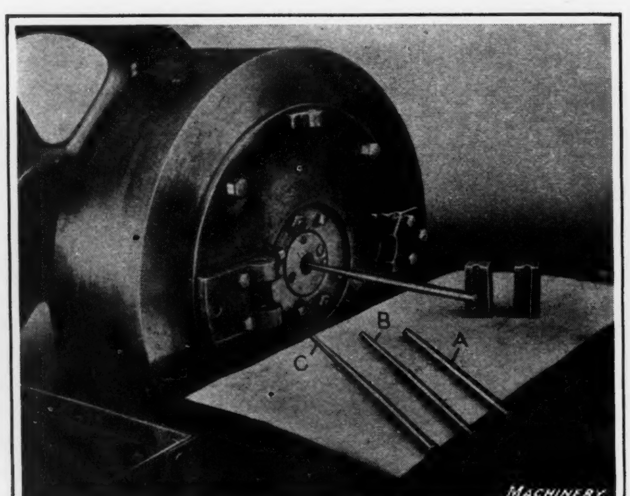


Fig. 2. Experimental Job performed on 7/16-inch Cold-drawn Stock, and Type of Dies used

be apparent that the revolving backers acting against the rolls will cause the rack also to revolve, but at a much slower rate than the spindle. This has the effect of distributing the pressure evenly on the work, increasing the degree of accuracy, and of so readjusting the molecules in the swaged material that it will be strengthened and its resilience retained.

Effect of Swaging on the Physical Properties of the Metal

It has long been known that hammering metal improves its physical qualities; hence swaging increases the strength of the material. The effect of swaging upon metal has been conclusively shown in the tests which have been conducted in the physical laboratory of the Torrington Co. A section of the laboratory in which tests of swaged wire are conducted is illustrated in Fig. 3. The equipment employed is standard, selected with a view to obtaining accurate strength values, so that the tests made to determine the effect of swaging wire, the results of which are here presented in tabular form, may be considered as authoritative. The machine shown at the left in Fig. 3 is a 50,000 pound capacity wire-testing machine manufactured by the Tinius Olsen Testing Machine Co., Philadelphia, Pa. The Greenfield Tap & Die Corporation's lantern projector shown in this illustration is made use of in a rather novel way in connection with the manufacture and inspection of swaging dies, as will be explained in the next installment of this article.

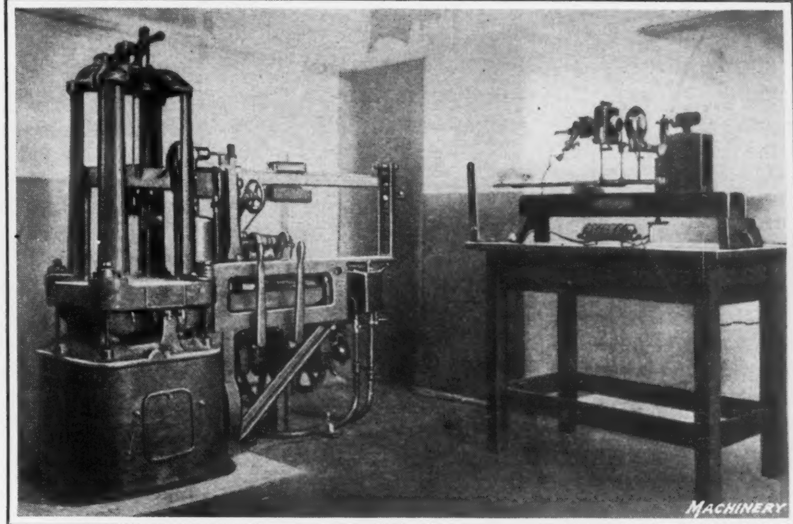


Fig. 3. View in Physical Laboratory, showing Tensile Testing Machine and Projector Apparatus

TABLE SHOWING INCREASE IN TENSILE STRENGTH OF SWAGED COLD-DRAWN STEEL WIRE

Diameter of Wire, Inch	Breaking Load, Pounds	Ultimate Strength, Pounds per Square Inch	Reduced Diameter, Inch	Breaking Load of Reduced Diameter, Pounds	Ultimate Strength of Swaged Part, Pounds per Sq. Inch	Per Cent Gain in Tensile Strength
0.175	3480	144,700	0.156	2900	152,000	4.8
0.205	4785	144,900	0.175	3648	152,000	4.9
0.285	7900	123,800	0.225	5900	148,000	19.5
0.347	14500	153,300	0.274	9920	168,000	9.6
0.404	17440	136,000	0.324	12690	153,000	12.5
0.467	21720	126,700	0.371	15570	144,000	12.0

Machinery

The accompanying table gives the results of six tests performed on the testing machine, in which wires ranging in diameter from 0.175 to 0.467 inch were used. The outstanding result is a substantial gain in tensile strength in every instance. The table shows that the test pieces used varied in initial strength from 123,800 pounds per square inch to 153,300 pounds per square inch. A significant fact brought out in these tests is that the greatest gain in tensile strength occurred in the wire of the least strength before swaging, the gain being 19.5 per cent. The increased tensile strength for the strongest wire (0.347 inch diameter) is less than 10 per cent, and for the two small diameter wires less than 5 per cent. This lesser gain in strength may be due to the fact that the percentage of reduction in diameter was much less than it was in the case of the larger test pieces.

It may be thought that, though the repeated hammering to which wire is subjected in swaging increases its strength, the inherent characteristics of the process may be destructive to the structure of the metal, and that its resiliency and ductility may be sacrificed at the expense of increasing its tensile strength. It appears that this is not true, and many experiments have been conducted with samples to show that the quality of the metal has not been impaired by the rapid-fire hammering to which it has been subjected. Fig. 6 shows a collection of twisted and bent samples which serves to emphasize this statement.

It is stated that tungsten is the only material that is not improved in structure by the process of swaging, all other metals being materially increased in strength without impairing their ductility and resilience.

One of the important applications of the swaging process, as previously mentioned, is the reduction in diameter and the tapering of tubes. There is no other method by which these operations can be so well performed. Among the classes of tubular work that are satisfactorily handled in this way are fire-hose nozzles and bicycle frame parts, in the larger work; and metal pencil shells and lightning rod ends in the medium-sized work. On tube work, where the tube is to be tapered or reduced to a uniform inside diameter, it is usually the practice to use a mandrel in the tube in order to maintain a uniform size.

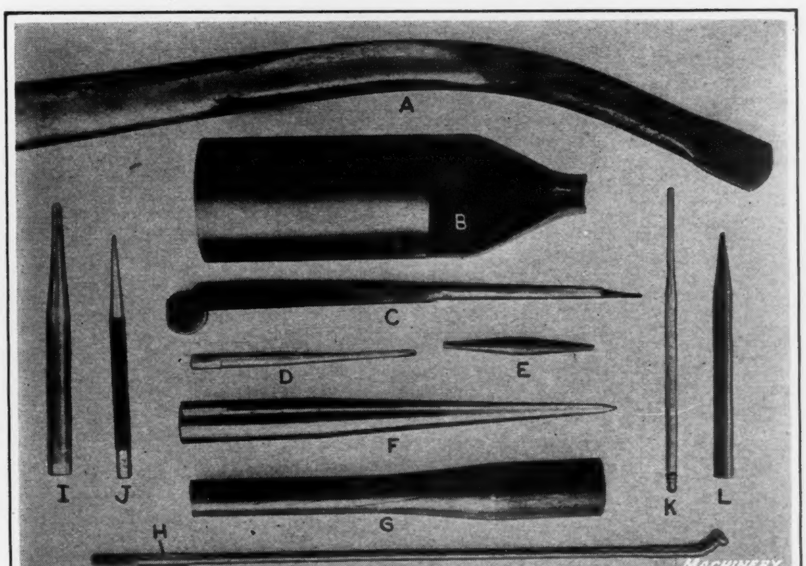


Fig. 4. Miscellaneous Collection of Swaged Work

Swaging Gold-plated Materials

It is well known that solid silver, platinum, and gold-plated base metal wire used in jewelry work, especially in the manufacture

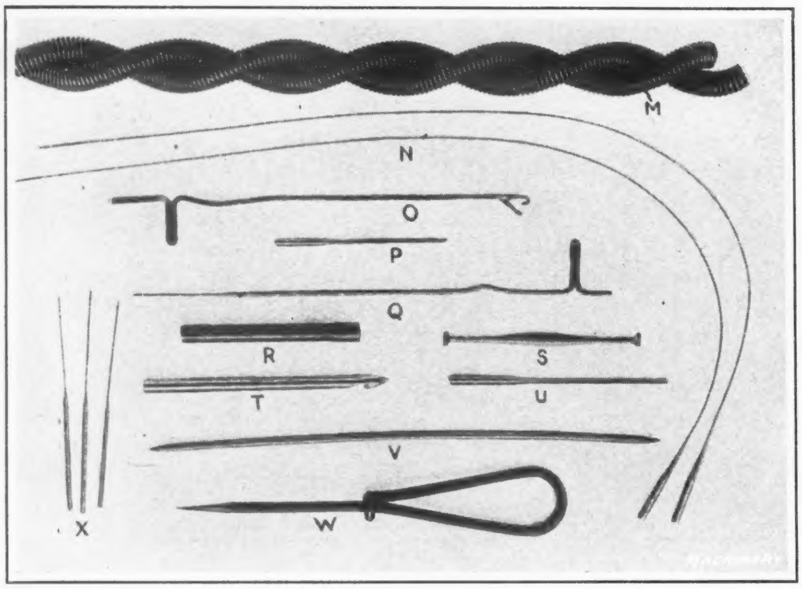


Fig. 5. Additional Examples of Cold-swaging

of spectacle bridges and bows, is produced by swaging. Perhaps it may not be so generally known that this is the only process by which a gold-plated base metal ingot may be reduced in diameter, from say, 1½ inches to the very small sizes extensively used in the optical and jewelry crafts, and at the same time produce a plated wire which will successfully withstand the acid test; yet it is stated that when a sample of this swaged wire is fractured and examined, the protective covering is so thin that there is no visible indication of an existing plate.

Although there appear to be no limitations to the amount of reduction that gold-plated bars will stand without destroying the plate, nothing can be done in the way of swaging casehardened steel. Gold-plated bars have a comparatively hard core and a soft plating which flows rapidly under the hammer; but casehardened steel has a hard exterior encasing the unhardened core. The hardened case will fracture and crumble under the battering-down effect of the swaging dies, and cannot be changed in sectional area by swaging until it has been properly annealed. In fact, where a number of passes through the dies are required to reduce a part, regardless of the kind of material, it is often necessary to anneal the material during the process of swaging in order to bring the metal to something like its original structural condition.

Producing Threads by Swaging

It may not be generally known that screw threads may be produced by swaging; but this is successfully and satisfactorily done from the coil, the wire passing through the dies and the hollow spindle of the swaging machine to a reel at the rear. The threaded wire thus produced, while not suitable for precision purposes, is extensively used for electrical and plumbers' supplies and for any purpose where merely a threaded rod is required. The characteristic of the swaged thread is its accuracy in lead rather than in thread form. The percussive action of the threading dies does not naturally lend itself to the production of threads of accurate form, while on the other hand, this method of producing a thread has the advantage of compensating for whatever inaccuracies might exist in the lead of any two successive threads of the die. The form of swaged threads is, however, not excessively irregular, nor does the action of the swaging dies destroy the ductility of the metal to any appreciable extent. The retention of ductility in swaged threads is shown in Fig. 5, in which at *M*, two threaded rods have been entwined without impairing the thread to any extent.

Amount of Diameter Reduction by Swaging

The amount of reduction in diameter that can be successfully effected by the swaging process is largely an empirical matter, depending on the size of the stock, its physical qualities, and a number of other factors. Small wire can be reduced the desired amount in one pass of the work through the dies, but on solid work which is large enough to withstand as great a reduction as 1/16 inch, a greater amount than this is not recommended in a single pass. This applies also to tubes if a mandrel is used; tubing swaged without a mandrel will stand a greater reduction however, than this. If, on the larger work, a greater reduction is attempted, the ends of the stock will become piped and have to be cropped off, causing a considerable loss of stock. This may be prevented by confining the amount of reduction effected at each pass to an amount not greater than that mentioned.

Examples of Swaging

In Fig. 2 are shown an experimental job and a pair of dies used for this work. A piece of cold-drawn stock *A*, 7/16 inch in diameter and 9½ inches long, was reduced about 2½ inches at one end in the first pass to 0.345 inch diameter, and was elongated thereby to 11 inches. This piece is shown at *B*. In the second reduction process the reduced diameter was further reduced to 0.253 inch and the over-all length increased to 12¼ inches, as shown by the sample *C*. These reductions were made under normal conditions, and give a fair idea of what may be expected on work of this size and nature.

Some difficulty may be experienced in swaging tapered parts, particularly if the taper is abrupt, by the ends of the stock splitting, and there appears to be no remedy for this except to employ a preliminary lathe operation to break down the ends of the work. After this has been done, the ends may be successfully tapered and will not pipe or split.

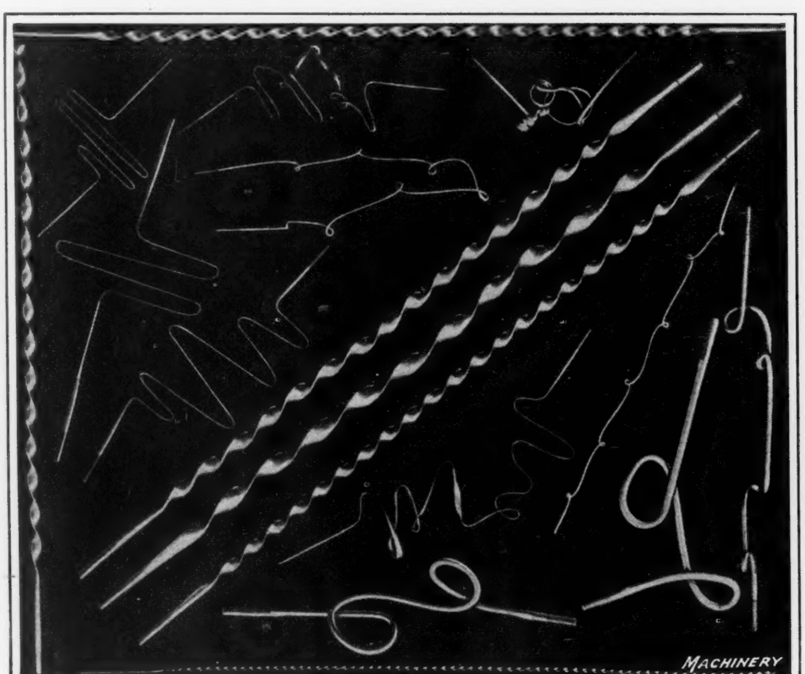


Fig. 6. Examples illustrating the Retention of Ductility in Swaged Work

An inspection of sample *B*, Fig. 4, will make it apparent that, where such abrupt tapers are produced, whether the stock is solid or tubular, some form of positive feeding device must be employed to overcome the axial thrust produced by the revolving dies. The Dayton swaging machine makes use of a rack and pinion feed for work of this type.

A high degree of accuracy can be obtained by the swaging process. In fact, swaging is extensively used for sizing wire, in which work a diameter can be readily and uniformly held to within limits of plus or minus 0.001 inch, or even less for the smaller sizes. A corresponding degree of accuracy can be obtained when reducing the diameter by swaging, this accuracy increasing if anything, with the smaller diameters of work. One of the chief advantages claimed for the swaging process, as compared with machining, is the saving of stock effected. Besides saving stock and improving the physical qualities of the metal, many subsequent finishing operations, such as lapping and grinding, may be eliminated; also, the resiliency of the metal is retained, as previously stated, even though it is increased in hardness and tensile strength.

Swaging is especially economical where the stock is run from a coil through the dies and wound on a reel at the rear of the machine; that is, in straight wire reduction or threading. Usually for all other swaging work, preliminary operations, such as cutting-off the blanks, and often subsequent operations such as pointing or a second swaging operation, are required. These separate operations, of course, increase the cost of parts for which swaging is employed. This is especially true if the saving in stock and improvement in its physical qualities are not considered, or if the degree of finish produced directly by swaging is not necessary for the product.

Rates of Production

Any statement relative to production by swaging must be qualified, for this is another matter in which no hard and fast rule can be given. In general it may be stated that where the work is of such a nature that one particular end of a piece must be presented by the operator to the swaging dies, a production of from 600 to 800 pieces per hour can be reached on small work, produced in one pass through the dies. If it is immaterial as to which end is swaged, and if the swaged portion is not longer than ¾ inch, a production of 1300 pieces per hour can readily be obtained. Where the reduction produces straight cylindrical sections, the production time per pass is mainly governed by the length of the swaged section. A production of 500 pieces reduced in diameter per hour is a conservative estimate for conditions such as these, where the length of the swaged portion is not in excess of 2½ inches. For tapered work a much higher production can be obtained, because the work can be withdrawn from the dies quickly and independently of the action of the swaging dies. On the other hand, straight cylindrical work cannot be withdrawn any quicker than it is advanced into the dies in swaging, so that while the production figures given may aid in obtaining an estimate, the foregoing factors should always be taken into consideration.

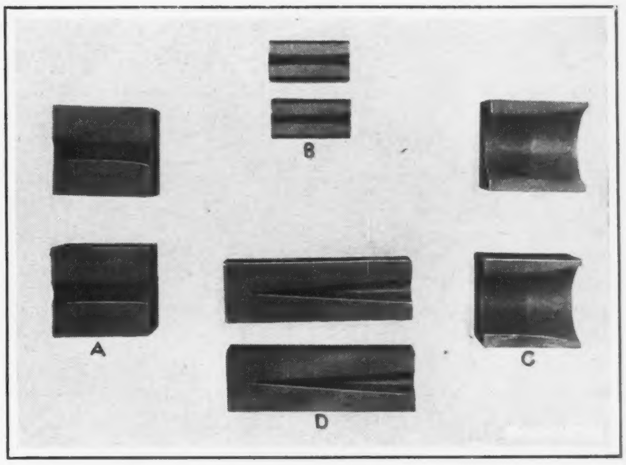


Fig. 8. Collection of Swaging Dies; (A) Straight Solid Stock; (B) Threaded Rods; (C) Tube Reduction; (D) Tapered Tubes

Types of Swaging Work

The collection of parts shown in Figs. 4 and 5 illustrates the type of work for which swaging is suitable, and has been selected to cover a wide range of work. Specimen *A* is one leg of a bicycle fork, which is swaged to a taper in two operations and then flattened. It should be emphasized again, while referring to these samples of work, that swaging accomplishes nothing but the reduction in diameter and the tapering; all other work is performed by a separate process. Sample *B* is a seamless wrought-steel tube, 2 inches outside diameter, which is rather abruptly swaged to an 11/16-inch diameter neck, and has been cut away to show the thickening up of the wall at the neck section. The piece shown at *C* is a compass leg made of formed sheet steel and swaged at the point. The piece shown at *D* is a flat drill for drilling wood, used with a combination kit. A brass tube is shown at *E*, which has been tapered at both ends so that they are practically closed. The diameter of the tube is 5/16 inch, and the length of taper 1 1/16 inches at each end.

Sample *F* is a lightning rod end made of 11/16-inch copper tubing and swaged to a point. The length of taper is 5¼ inches, and the over-all length 7½ inches. The dies used in the production of this piece are shown at *D*, Fig. 8. The extra heavy brass tube shown at *G* has been swaged from 0.940 inch in diameter to 0.620 inch for a straight length of about 3 inches. The production of wheel spokes such as used for bicycles and automobile wheels is commonly accomplished by swaging. Such a spoke is shown at *H*, being reduced at its central portion from 0.206 inch diameter to 0.174 inch.

The samples shown at *I* and *J* are nail sets, in the partially and fully completed condition. It is in work such as this, where solid stock is rather sharply tapered, that

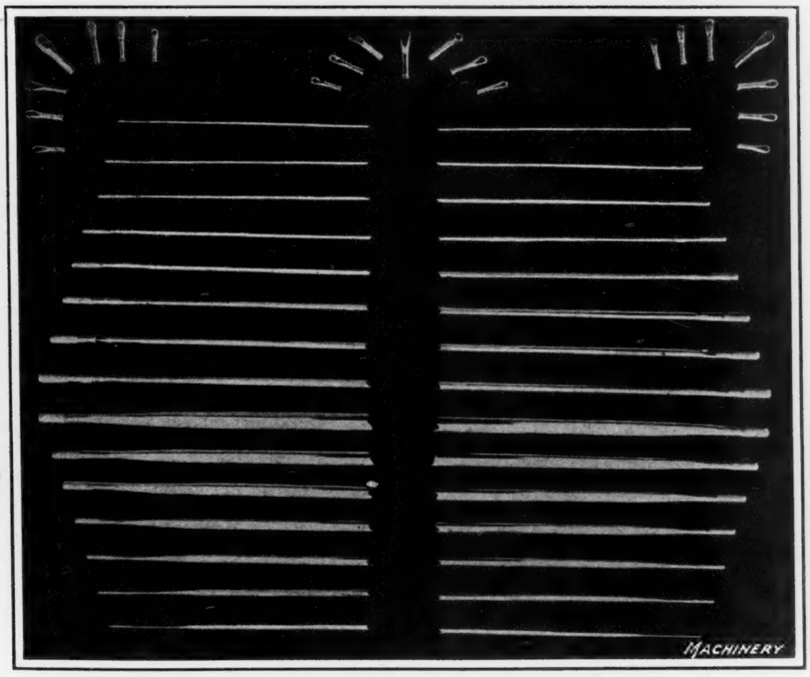


Fig. 7. Airplane Tie-rods reduced in Diameter between the Ends by Swaging

difficulty is likely to arise by the metal piping or splitting at the ends, necessitating the preliminary breaking down of the stock at the end in a lathe. On the size of nail set shown at *I*, the stock is reduced from 3/8 inch to 0.150 inch on the straight portion with a taper 1½ inches long, requiring two operations. The sample *J* is a smaller size, the original diameter of stock being ¼ inch and the length of taper 1 7/16 inches, produced in two operations.

At *K* is shown a crochet hook, 3/16 inch in diameter, which has a 3/8-inch abrupt taper to 0.127 inch, and from there on a gradual taper to 0.110 inch. The length of this gradual taper is 1 3/8 inches. A brass shell such as used for metal pencils is shown at *L*. The outside diameter is 5/16 inch, swaged to a blunt point, approximately 0.066 inch in diameter, with a length of taper of 15/16 inch. This brass shell was first drawn with a closed end and then swaged to the shape shown.

In Fig. 5 the appearance of swaged threads is shown at *M*. These two brass rods are ¼ inch in diameter, and have standard threads 24 per inch. At *N*, *S* and *V*, are shown samples of gold-plated wire reduction work. The first of these is a pair of spectacle bows of 0.07 inch plated base metal wire, reduced to 0.021 inch, while *S* is a spectacle bridge piece tapered at both ends and flattened subsequently as shown. The piece of gold-plated wire *V* is 4¼ inches long and 0.065 inch in diameter, pointed at both ends for a distance of 3/8 inch.

At *O* and *Q* are shown a latch needle and a knitting needle blank, respectively, the swaging work on which consists merely of reducing the diameter at the end. Two other needles are shown at *P* and *T*, the first being a sewing machine needle and the latter a hook needle used on shoe machinery. There is nothing remarkable about the swaging operations on needles, except that swaging is the only method used to produce the points before they are finally sharpened by grinding.

The brass tube at *R* shows the result of the first operation in reducing the diameter from 0.165 to the finished diameter of 0.102 inch; the first reduction produces a straight section 0.150 inch long. This tube is used on player pianos. Another needle blank is shown at *U*, swaged from 0.105 to 0.038 inch in diameter, the straight section being 1 3/16 inches long. The amount of reduction in diameter of this sample and the abruptness of the taper between the two cylindrical sections demands that two passes of the work be employed to obtain the desired reduction. At *W* is shown an embroidery punch made from 0.086 inch diameter steel wire, swaged for a length of 7/16 inch at the end to a point. The three small specimens at *X* are steel points used for drafting machines. These are made from 0.45 inch diameter steel wire, and are reduced to a straight section 13/16 inch long and 0.010 inch in diameter. Among the large variety of small work produced by swaging may be mentioned dental instruments, instrument points of various kinds, balance pins for speedometers, etc.

While these parts are intended to be representative of the scope of swaging, it should be mentioned that large work such as fire-hose nozzles, for example, is taken care of by the capacity of the machine, it being possible to handle solid work up to a diameter of 2 inches and tubing up to 2¼ inches in diameter with standard capacity machines.

Swaging has become closely identified with the manufacture of airplanes in the production of tie-rods and streamline rods used in the construction and support of the wings. Fig. 7 shows a display board with sections of the rods used on the DeHaviland-4 airplane. These range in diameter from about 1/8 to ½ inch, and are threaded on the ends and reduced at the central diameter by swaging. The over-all length of the longest of these rods is about 20 feet. It is evident that any other method of machining would not produce a rod which would compare favorably with the swaged rod. It will be understood that the work performed by swaging is simply that of reducing the circular sectional area between the ends, and that those rods that are of oval section are flattened in a separate operation.

In a subsequent article the steel used for swaging dies and the methods employed in making these dies will be dealt with. The heat-treatment of the steel for swaging dies will be explained, and reference will be made to the use of the projectograph for swaging-die inspection.

* * *

SIMPLIFIED GEAR CALCULATION

By G. T. JOHNSON

The formula and table of constants here given have been worked out by the writer to eliminate the trial method of obtaining the number of teeth in a gear and also the number of teeth in its mating pinion when the pinion and gear are required to operate at a given center distance and speed ratio.

The problem is to find the number of teeth in the pinion and the number of teeth in the gear when the center distance, the diametral pitch, and the speed ratio are given.

TABLE OF CONSTANTS FOR SIMPLIFIED GEAR CALCULATION

R	S	R	S	R	S	R	S
1.0	1.00	3.0	2.00	5.0	3.00	7.0	4.00
1.1	1.05	3.1	2.05	5.1	3.05	7.1	4.05
1.2	1.10	3.2	2.10	5.2	3.10	7.2	4.10
1.3	1.15	3.3	2.15	5.3	3.15	7.3	4.15
1.4	1.20	3.4	2.20	5.4	3.20	7.4	4.20
1.5	1.25	3.5	2.25	5.5	3.25	7.5	4.25
1.6	1.30	3.6	2.30	5.6	3.30	7.6	4.30
1.7	1.35	3.7	2.35	5.7	3.35	7.7	4.35
1.8	1.40	3.8	2.40	5.8	3.40	7.8	4.40
1.9	1.45	3.9	2.45	5.9	3.45	7.9	4.45
2.0	1.50	4.0	2.50	6.0	3.50	8.0	4.50
2.1	1.55	4.1	2.55	6.1	3.55	8.1	4.55
2.2	1.60	4.2	2.60	6.2	3.60	8.2	4.60
2.3	1.65	4.3	2.65	6.3	3.65	8.3	4.65
2.4	1.70	4.4	2.70	6.4	3.70	8.4	4.70
2.5	1.75	4.5	2.75	6.5	3.75	8.5	4.75
2.6	1.80	4.6	2.80	6.6	3.80	8.6	4.80
2.7	1.85	4.7	2.85	6.7	3.85	8.7	4.85
2.8	1.90	4.8	2.90	6.8	3.90	8.8	4.90
2.9	1.95	4.9	2.95	6.9	3.95	8.9	4.95

Machinery

The speed ratio R of the pinion and gear is found by the formula:

$$R = \frac{\text{Revolutions per minute of pinion}}{\text{Revolutions per minute of gear}}$$

The formula for the number of teeth t in the pinion is:

$$t = \frac{C \times D}{\dfrac{R+1}{2}}$$

The number of teeth T in the gear is found by the formula:

$$T = t \times R$$

In these formulas

R = speed ratio of pinion and gear;

C = center distance between the gear shafts; and

D = diametral pitch.

Thus for either diametral or circular pitch gears, the formula for obtaining the number of teeth t in the pinion is

$$t = \frac{\frac{1}{2}(t+T)}{\dfrac{R+1}{2}}$$

To use the accompanying table of constants, simply substitute the value given in column S (opposite the required speed ratio R) for the expression $\dfrac{R+1}{2}$ in the formula.

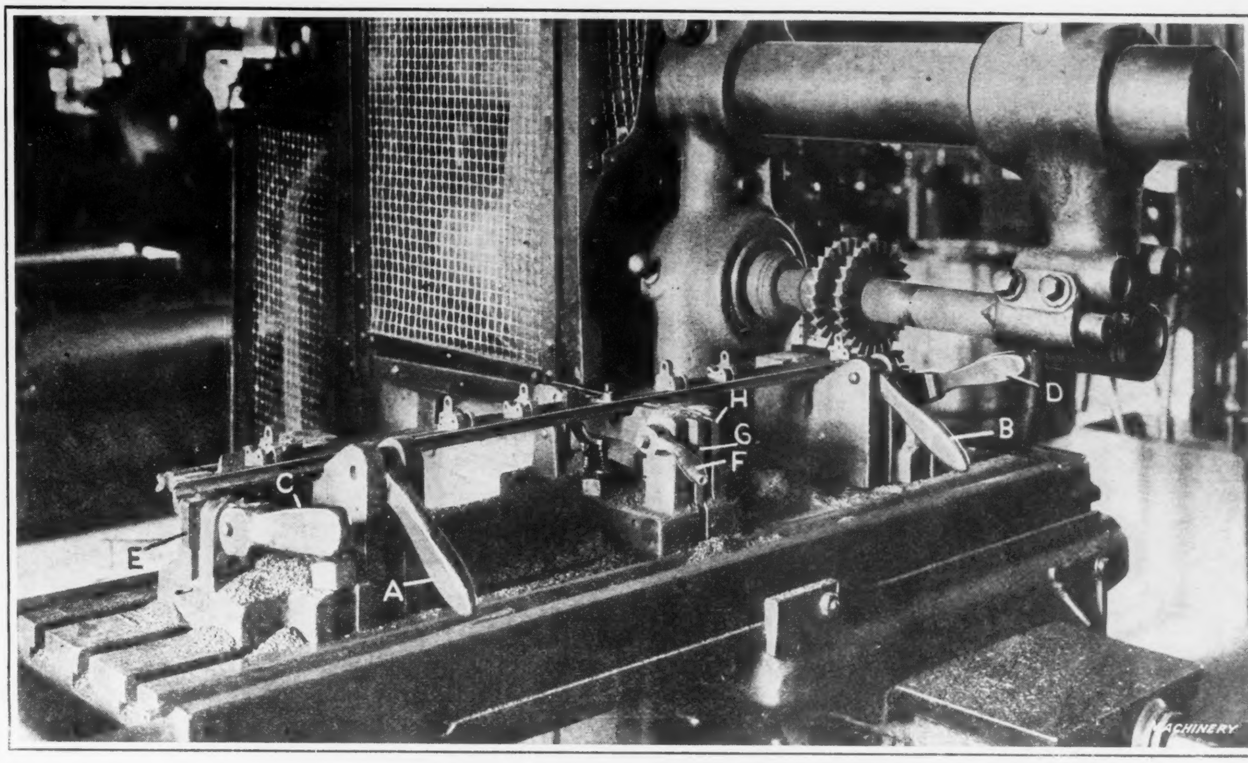


Fig. 1. Milling One Side of a Long Cast-iron Bed Rail for the Monarch Typewriter

Milling Slender Castings

Fixtures Used at the Smith Premier Works of the Remington Typewriter Co. for Holding Slender Parts without Springing

By FRANKLIN D. JONES

THE manufacture of typewriters involves many difficult problems relating to the design of special fixtures, tools, and machines. Large numbers of duplicate parts must be produced accurately and rapidly, and the manufacturing problem is further complicated by the fact that a modern typewriter requires numerous parts differing greatly in size and shape. Many of these pieces are also slender, and for this reason must be held for different machining operations in fixtures especially designed to prevent distortion due to the pressure of clamping devices. At the Smith Premier Works of the Remington Typewriter Co., in Syracuse, N. Y., difficulties formerly encountered in milling slender pieces, such as the bed and carriage rails of the typewriter, were overcome by the application of two important principles, one relating to the design of the milling fixtures, and the other to the method of milling. The fixtures will be considered first, and then the effect of the milling operation itself on the accuracy of the product will be taken up.

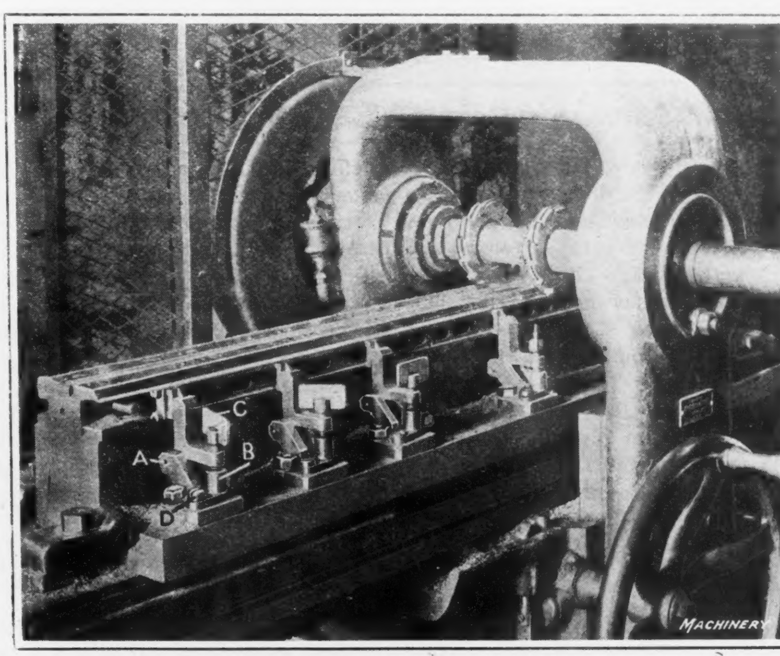


Fig. 2. Milling V-shaped Ball Races along Edges of Two Bed Rails held on Opposite Sides of Fixture

One of the parts that is easily distorted if not held and milled properly is the cast-iron bed rail. This slender casting is sometimes required in lengths up to 42 inches when used on typewriters having special carriages that are much longer than the standard size. These castings have milled surfaces on the sides, and a V-groove is cut along each edge to form a ball race or track. In order to secure an easy, free movement of the carriage, these ball races must be straight. The milling fixtures used for the bed rails have been very carefully designed to prevent any springing of the casting, and at the same time hold it securely enough for the milling operation.

Fig. 1 shows the first milling operation on a bed rail casting. The particular bed rail shown in this illustration is intended for one of the long carriages. As will be seen, three separate fixtures are mounted on the table

of the machine. The fixtures at the ends grip the casting, while the one in the center supports it firmly but without subjecting the casting to vertical or lateral pressure sufficient to spring it even slightly. Each of the eccentric levers *A* and *B* of the end fixtures bears against a pivoted clamp, which is forced inward for gripping the side of the casting. The eccentric levers *C* and *D* clamp the outer ends of spring levers *E*, after the latter, with their small contact pins, have been pushed lightly upward against the under side of the casting by small springs. The lever *F* of the central fixture binds two spring-controlled equalizing supports *G* and *H*. When exceptionally long castings are to be milled, two of these central supporting fixtures are used.

Milling Fixtures for Supporting Typewriter Bed Rails

The design of these fixtures is shown more clearly in Fig. 3, which illustrates the same general type as shown in Fig. 1. The outline of the bed rail is indicated by dot-and-dash lines in both the side elevations and plan views. The end view at the left shows the arrangement for gripping the casting. Lever *A*, which has an eccentric surface, bears against clamp *J* which is pivoted at *K*. This clamp has a V-shaped jaw, and there is a similar jaw on the other side of the casting. The supporting levers *E* for the ends are pivoted at *L*, and are held lightly in contact with the under side of the work by springs *M*; levers *E* are then firmly held in this position by levers *C* and *D*.

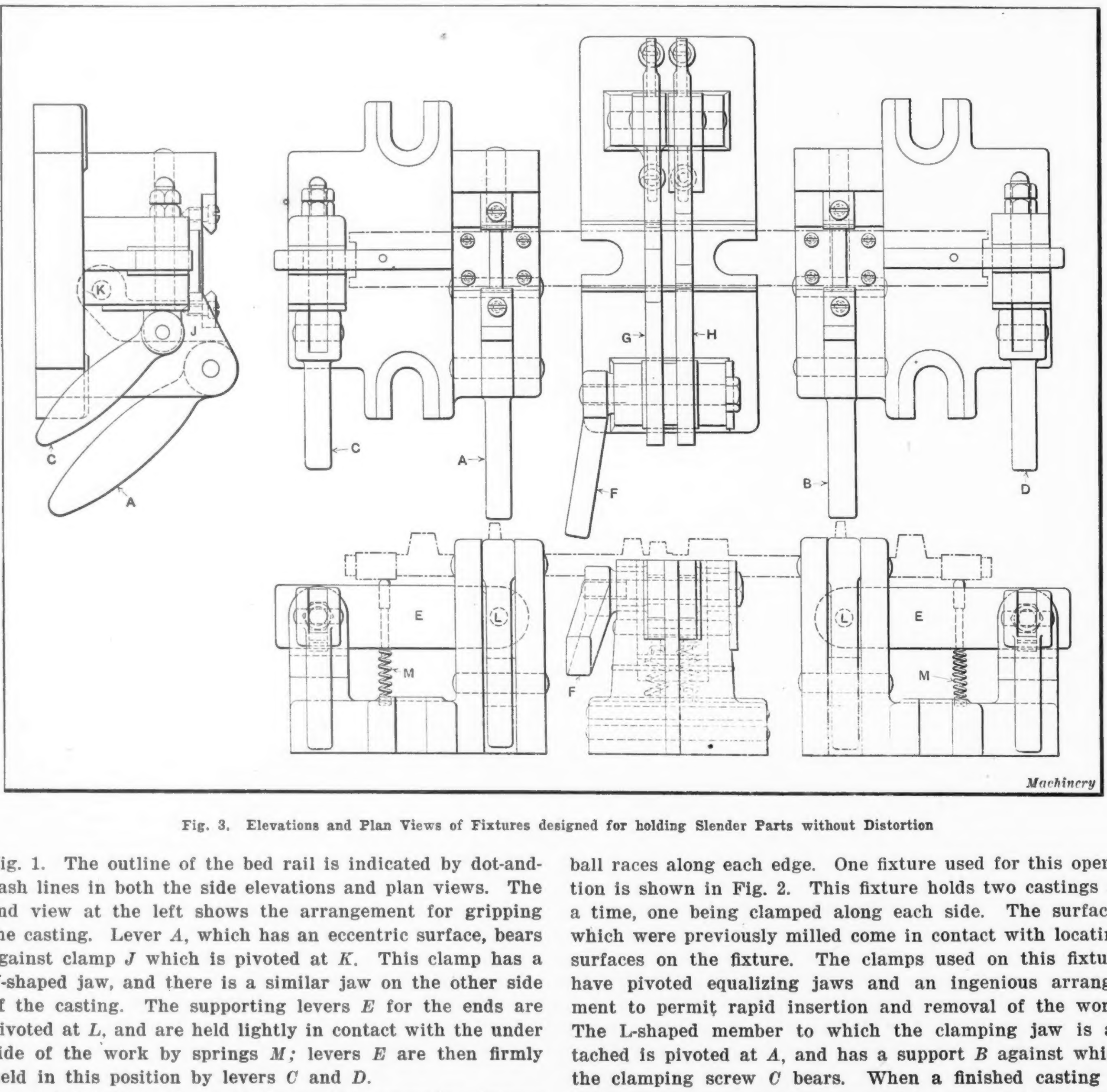


Fig. 3. Elevations and Plan Views of Fixtures designed for holding Slender Parts without Distortion

A detailed view of one of the central supporting fixtures is shown in Fig. 4. This fixture is of the same general type as the one in use in Fig. 1. The position of the work relative to this fixture is indicated by the cross-section at *N*. The equalizing supports *H* and *G* are pivoted at *P* and *Q* to links which are free to swing about the lower pivot *T*. An extension *U* at the lower end of each link has beneath it a spring *V*, and attached to extensions *W* on the equalizing supports are additional springs *X*. A compression spring is used for support *H* and a tension spring for support *G*, as shown. Both of the springs *X* are tension springs. The support *H* has a V-shaped jaw that comes in contact with the left-hand side of the casting, as shown in the illustration, and a clearance space on the opposite side. This order is reversed in the case of support *G*. Clearance holes are provided in the supports at *Y*, and the bolt of clamp lever *F* passes through these holes. With this arrangement these supports are free to move laterally and vertically, so that they automatically come in contact with the sides and bottom surface of the casting when the latter is placed in the fixture, but the springs *V* and *X* which hold them in engagement with the work are not strong enough to spring the casting out of shape. A partial turn of lever *F* securely locks members *H* and *G*, so the work is firmly supported.

After the flat surfaces have been milled on one side of the casting by the use of the equipment illustrated in Fig. 1, the work is ready for milling the V-shaped grooves or ball races along each edge. One fixture used for this operation is shown in Fig. 2. This fixture holds two castings at a time, one being clamped along each side. The surfaces which were previously milled come in contact with locating surfaces on the fixture. The clamps used on this fixture have pivoted equalizing jaws and an ingenious arrangement to permit rapid insertion and removal of the work. The L-shaped member to which the clamping jaw is attached is pivoted at *A*, and has a support *B* against which the clamping screw *C* bears. When a finished casting is to be removed, screw *C* is loosened by a partial turn, and then support *B*, which is pivoted at *D*, is swung out of the way, thus allowing the L-shaped clamping member to drop down clear of the work.

Fixture Used in Milling Ball Races in Typewriter Carriage Rails

Another delicate milling operation is illustrated in Fig. 5. The work in this case is the lower carriage rail. It is formed of sheet steel, 3/32 inch thick, and the operation

is that of milling a 90-degree ball race. This race, which is formed by rolling and is approximately straight for milling, must be trued by removing a very small amount from the surface of the V-groove, and an exceptionally good support without the slightest tendency to spring the work is necessary. The fixtures used are similar in principle to those already described, but differ slightly in regard to the arrangement. At each end there is a clamping jaw *A* which is normally held upward to permit insertion of the work by spring *B*, and is forced downward for clamping by lever *C*, having an eccentric end surface. Two supporting bars *D* and *E* are placed between the end-clamping fixtures. These bars have V-shaped grooves to fit the lower side of the carriage rail, and they are of the spring-supported equalizing type, operating on the same general principle as the fixture illustrated in Fig. 3.

Effect of Rate of Feed on Distortion of Work

Notwithstanding the precautions taken in designing fixtures for holding these slender parts, excessive distortion would still occur if the milling were not done properly. By studying cause and effect, it was found that the rate of feed used for milling has a decided influence on the distortion of such slender parts as the bed and carriage rails. When a fine feed is used, there is considerable distortion, but when the feed is coarse, the distortion is not great enough to cause trouble. This fact has been proved by milling the parts under exactly the same conditions except for the rate of feed.

Why should a fine feed cause distortion of the work? Here is an explanation. The uniformly spaced marks seen on milled surfaces are revolution marks, caused by some irregularity of the cutter, such as a tooth which differs slightly from the others and leaves a mark every revolution. Now, as this irregular tooth comes around, it strikes the work with greater force than the others and exerts what might be defined as a peening action. The irregularity of the cutter is, of course, very slight in any case, but, nevertheless, the effect on the work may be pronounced when the feed is too fine, because the peening action due to the irregularity in the cutter is greater, or occurs oftener, in a given length with a fine feed than with a coarser feed; consequently, there is greater distortion, and the amount of distortion from this cause is surprising when the work is long and slender and easily sprung out of shape. The discovery of this relation between the rate of feed and the straightness of milled parts eliminated a great deal of trouble and expense at the Smith Premier Works.

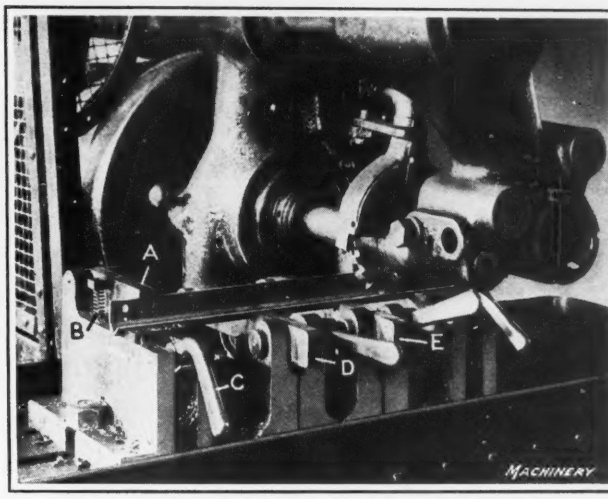


Fig. 5. Milling Ball Groove along Steel Carriage Rail

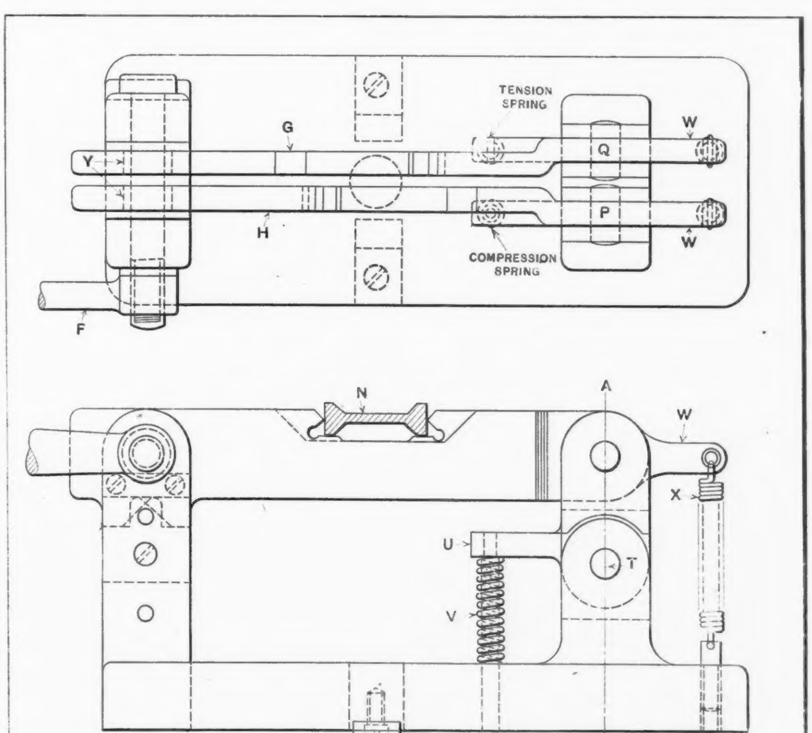


Fig. 4. Supporting Fixture used in Conjunction with Clamping Fixtures when milling Slender Parts

* * *

RAILROAD SHOP EFFICIENCY

The following example of the extremes to which the labor unions have gone in their sub-division of the labor to be done by different crafts in railroad shops has been furnished by railway officials in order to inform the Railway Board as to the actual conditions with which it has to deal in deciding upon the abrogation of some of the rules at present in force and the steps to be taken for increasing the efficiency of labor in the railroad shops.

In order to change a nozzle tip in the front end of a locomotive it is necessary:

1. To call a boilermaker and his helper to open the door, because that is boilermaker's work.
2. To call a pipeman and his helper to remove the blower pipe, because that is pipeman's work.
3. To call a machinist and his helper to remove the tip, because that is machinist's work.

The same three forces must be employed to put in the new tip. Before federal control a machinist's helper or any handyman put in nozzle tips alone. Similarly, railroads are required to employ members of three crafts—machinists, sheet metal workers, and electricians and their helpers—to make a repair to a locomotive headlight, which was formerly handled by one or two men. Under such restrictions it is impossible for railroad shops to be conducted efficiently.

* * *

In Joseph Roe's book on "English and American Tool Builders," it is mentioned that in 1832, M. W. Baldwin, the founder of the Baldwin Locomotive Co., built an engine for the Philadelphia and Germantown Railroad which was placed on the road in January, 1833. An advertisement of that time says: "The locomotive engine built by Mr. M. W. Baldwin of this city will depart daily, when the weather is fair, with a train of passenger cars. On rainy days horses will be attached in the place of the locomotive."

JUNE, 1921 MACHINERY VOL. 27 NO. 10

Published Monthly by
THE INDUSTRIAL PRESS
140-148 LAFAYETTE ST.
NEW YORK

ENGLAND
51-52 CHANCERY LANE
LONDON

CABLE ADDRESSES
MACHINERY, NEW YORK
MACHTOOL, LONDON

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PREPARE FOR BUSINESS NOW

Many of our manufacturers are preparing for the volume of business we all expect before long. Steel mills have been particularly busy in rehabilitating their plants, making necessary repairs and even installing some new equipment. Paper mills are enlarging their facilities; and although they are now running short time, some are installing machinery ordered last year so that when the demand again becomes normal they will be prepared to meet it. The textile industry also sees the turn ahead and is putting its plants in order.

It requires courage and vision to spend money on repairs or stock when there are no orders in sight, although everyone knows that more material and labor can be obtained per dollar under present conditions than after business revives. Plants can be rearranged and changes made now without interrupting production that will result in economies when the plant is again operating. It is true economy to prepare for business now.

The late F. E. Reed of Worcester, one of the ablest men in the machine tool industry, made no small portion of his great fortune by building lathes when business was slack, and he was always ready with a large stock of carefully made tools when demand reappeared. Business is as certain to revive now as it was in Mr. Reed's time, and his policy is a safe one to follow.

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MACHINE TOOL STATISTICS NEEDED

There is almost no statistical information available to guide the individual machine tool manufacturer in shaping his manufacturing and selling policy. He must base his estimate of possible sales on his orders and on fragmentary information concerning the business of possible users of his machines. It is becoming more and more apparent that reliable and comprehensive statistics covering production and sales in any industry are of great value to all engaged in it; and the individual manufacturer, in furnishing such details about his own business confidentially to a central bureau or organization, should receive far more information than he gives, by obtaining the current statistics of the industry. Because manufacturers generally are reluctant to give out information of this character, they are obliged to apply the old cut-and-try methods to the commercial end of their business.

The National Machine Tool Builders' Association is now endeavoring to compile production statistics, which should be of great value to all members if they are only nearly complete. Suppose that a shaper manufacturer, planning to increase his stock, knew the total number of shapers unsold in the hands of manufacturers and dealers, and the approximate capacity of the market; would not that information be a great help in determining his manufacturing policy? Suppose that comprehensive statistics were available covering five or ten years past, showing the total domestic and export consumption of the different classes of machine tools, together with adequate information of the present total capacity of the machine tool plants in the country; would not such information be a real help in deciding policies for the future?

If statistics covering production, orders booked, shipments, and the total amount of orders on hand were given out each month, of course mentioning no names, but giving the total figures of all manufacturers for different lines of machine tools, each manufacturer could form a reasonably accurate opinion of present conditions and of the immediate future. Now they can only guess. It is admitted by manufacturers that if such statistics had been available a year ago all would have been better off today, because provision could have been made for the decline in business much sooner than was done.

The collection of such information is one of the greatest services that the National Machine Tool Builders' Association can at the present time render its members and the industry. If there are any details in connection with this work to which individual manufacturers object, it is surely possible by cooperation to overcome them, so that this important service may become operative.

* * *

PUBLICITY THAT PAYS

The value of a circular or catalogue of machine tools and accessories is materially increased by being truly descriptive of the product advertised. Many circulars and catalogues contain too little of the definite information which the ultimate users in the shop—the superintendent, the foreman and the shop men in general—are looking for. Vague and general phrases are too common. The descriptions of the machines or devices often consist of generalities which, if analyzed, would be just as applicable to a similar machine built by a competitor.

The prospective purchaser can form no intelligent opinion as to the comparative merits of two machines if the information furnished to him is given in the vague terms often found in printed descriptions. Such expressions as "The best materials are used in its construction throughout," "The bed is designed so as to insure maximum rigidity," mean little or nothing, because such statements are often as true of one machine as of another in the particular class referred to. Advertising literature should describe the distinctive features of the machine—the particular points wherein it differs from competing machines and is superior to them. The advantages gained by the user from these distinctive features should be clearly explained.

One object of advanced mechanical advertising is to visualize on paper the kind of work for which a machine is particularly adapted. This is an important point, because with the great variety of somewhat special types of machine tools and attachments now on the market it is not always apparent that the machine or device in question would be especially applicable to the prospective customer's work.

In the preparation of circulars and catalogues, close cooperation is desirable between the engineering staff, who are conversant with the technical points to be described, and the advertising and sales staff, whose training qualifies them to present such descriptive matter in convincing form.

The Center of the Machine Tool Industry

According to the 1920 census, the "center of population" is now located in the southwestern part of Indiana, having moved westward about eight miles during the last decade. The "center of the machine tool industry" has also been moving westward during the past fifty years, somewhat slowly during the seventies, then quite rapidly during the eighties and nineties, and again more slowly during the past twenty years. A brief review of this westward movement will probably interest those now connected with the industry.

In the middle of the last century the building of machinery of all kinds was concentrated on the Atlantic Coast. Fifty years ago, practically all the machine tool building shops in the United States were located in New England, New Jersey and eastern Pennsylvania. The important machine tool building centers at that time were Providence; Hartford; Worcester; Fitchburg; Windsor, Vt.; Philadelphia; and Newark, N. J.

TABLE 1. CITIES AND TOWNS BUILDING OVER 98 PER CENT OF THE MACHINE TOOLS IN THE UNITED STATES

Based Upon Number of Men Employed in Machine Tool Shops—Not Including Small Tools—at the Time of the Armistice, 1918. Percentages given show Comparison with Entire Machine Tool Industry of the United States

City or Town	Per Cent	City or Town	Per Cent	City or Town	Per Cent	City or Town	Per Cent
Cincinnati, Ohio	11.8	Torrington, Conn.	1.12	Springfield, Ohio	0.28	Kenton, Ohio	0.13
Cleveland, Ohio	8.1	Pawtucket, R. I.	0.94	Nashua, N. H.	0.28	New Haven, Conn.	0.13
Providence, R. I.	7.3	Springfield, Mass.	0.88	Baltimore, Md.	0.27	Danbury, Conn.	0.12
Hartford, Conn.	5.3	South Bend, Ind.	0.74	Tiffin, Ohio	0.26	Freeport, Ill.	0.11
Worcester, Mass.	4.6	Moline, Ill.	0.69	Waltham, Mass.	0.26	New Castle, Ind.	0.11
New York City	3.6	Sidney, Ohio	0.68	Ridgway, Pa.	0.25	Waterbury, Conn.	0.11
Philadelphia, Pa.	3.3	Covington, Ky.	0.65	Kokomo, Ind.	0.24	Bay City, Mich.	0.11
Hamilton, Ohio	2.8	Grand Rapids, Mich.	0.65	Greenfield, Mass.	0.21	Louisville, Ky.	0.11
Bridgeport, Conn.	2.7	Pittsburg, Pa.	0.59	Dubuque, Iowa	0.20	Glendale, N. Y.	0.11
Rockford, Ill.	2.6	Syracuse, N. Y.	0.55	Winchendon, Mass.	0.20	Yonkers, N. Y.	0.11
Rochester, N. Y.	2.4	Saginaw, Mich.	0.54	St. Mary's, Ohio	0.19	Defiance, Ohio	0.10
New Britain, Conn.	1.93	Elkhart, Ind.	0.52	Mt. Gilead, Ohio	0.19	Portland, Maine	0.10
Fitchburg, Mass.	1.87	Chambersburg, Pa.	0.52	Racine, Wis.	0.19	Bristol, Conn.	0.10
Chicago, Ill.	1.85	Jackson, Mich.	0.50	St. Louis, Mo.	0.19	Brazil, Ind.	0.10
Madison, Wis.	1.85	New London, Conn.	0.46	Massillon, Ohio	0.18	Westboro, Mass.	0.09
Waynesboro, Pa.	1.71	Fond du Lac, Wis.	0.44	Beloit, Wis.	0.18	Minster, Ohio	0.09
Boston, Mass.*	1.70	Indianapolis, Ind.	0.43	Bridgeton, N. J.	0.17	Barre, Mass.	0.09
Buffalo, N. Y.	1.67	Dexter, Maine	0.43	Detroit, Mich.	0.16	Aurora, Ind.	0.08
Newark, N. J.	1.63	Wilmington, Del.	0.42	Royersford, Pa.	0.16	Peru, Ind.	0.07
Milwaukee, Wis.	1.58	Hudson, Mass.	0.41	Braddock, Pa.	0.15	New Bremen, Ohio	0.07
Toledo, Ohio	1.57	Franklin, Pa.	0.36	Salem, Ohio	0.15	Edwardsville, Ill.	0.07
Springfield, Vt.	1.54	Davenport, Iowa	0.35	Holland, Mich.	0.15	Meadville, Pa.	0.07
Plainfield, N. J.	1.27	Hastings, Mich.	0.34	Canton, Ohio	0.14	Conneaut, Ohio	0.06
Windsor, Vt.	1.15	Richmond, Ind.	0.33	Paterson, N. J.	0.13	La Salle, Ill.	0.06
Erie, Pa.	1.13	Seneca Falls, N. Y.	0.31	Muskegon, Mich.	0.13	Xenia, Ohio	0.06

Machinery

*Includes Cambridge, Mass.

Comparisons by Sections

No statistics of the machine tool industry are available before 1899, showing either the number of plants in existence or the value of the product. By that time the Ohio machine tool builders had become well established; and as the accompanying tabulation shows, the proportion of product between the New England and the Ohio manufacturers has remained practically unchanged since then. The relative importance of New York, New Jersey and Pennsylvania as machine tool building states has decreased, while that of Illinois, Indiana, Michigan and Wisconsin has increased.

In 1899 the total value of the metal-working machinery built in the United States was about $25,000,000, of which machine tools represented $18,000,000. The statistics for 1899 do not show separately for each state the value of the machine tools built, but include all metal-working machinery. The New England states were responsible for 32 per cent of the total; New York, New Jersey and Pennsylvania, 26 per cent; Ohio, 30 per cent; and Illinois, Indiana, Michigan and Wisconsin, practically the entire remainder—12 per cent.

In 1904 the depression in the machine tool industry affected the Ohio manufacturers more than those in New England, so that of the total production of metal-working machinery in that year, the New England states were responsible for 35 per cent; New York, New Jersey and Pennsylvania, 24 per cent; Ohio, 25 per cent; while Illinois, Indiana, Michigan and Wisconsin had increased their quota to about 16 per cent. The total production of metal-working machinery in 1904 was valued at $32,000,000, of which $18,000,000 represented machine tools. These figures show that there was no increase in the value of the machine tools produced in 1904 as compared with 1899; due doubtless to the depression in the latter year.

Census of Manufactures for 1914

Unfortunately, the census of the machine tool industry has been taken in years when this industry was subjected to a depression. The next census after 1904 was that of 1914 when for the first time machine tools were classified entirely by themselves. According to this census, the total value of the machine tools produced in that year was $31,500,000. Of this total New England was responsible for 35 per cent; New York, New Jersey and Pennsylvania, 18 per cent; Ohio, 29 per cent; and Illinois, Indiana, Michigan and Wisconsin, about 18 per cent. These figures show that New York, New Jersey and Pennsylvania lost in relative importance as machine tool producing states as compared with 1899 and 1904, while Illinois, Indiana, Michigan and Wisconsin gained. The balance between New England and Ohio remained practically the same as in 1899.

The Machine Tool Industry in 1918

The great development that took place in the machine tool industry from 1914 to 1918 did not materially affect the proportion between New England and the middle-western states that has been maintained with comparatively small changes for the past twenty years. Census figures are not available showing the total value of the products of the machine tool manufacturers in 1918, but an estimate may be based upon the total number of men employed in the industry in 1918 (77,000), from which it may be assumed that the total value of the machine tools built in that year was between $300,000,000 and $400,000,000.

A tabulation of the number of men employed in the machine tool industry in 1918 was made by the Machine Tool Section of the War Industries Board. According to these figures, New England in 1918 employed 34.6 per cent of the workers in the industry; Ohio, 27.9 per cent; New York, New Jersey and Pennsylvania, 20.5 per cent; while Illinois, Indiana, Michigan and Wisconsin employed 15.3 per cent, the remaining 1.7 per cent being scattered over a number of the other states where machine tools were built. In the Ohio figures those for Kentucky are included, as practically all the machine tool building in Kentucky is located in Covington, across the river from Cincinnati.

The Center of the Machine Tool Industry

The figures given indicate that New England and Ohio up to the present time are practically holding the same proportionate places in the machine tool industry as they held in 1899. The percentage loss of New York, New Jersey and Pennsylvania is made up for by the increases in Illinois, Indiana, Michigan and Wisconsin, showing that the actual center of the machine tool building industry is gradually, if slowly, moving westward.

An attempt to determine the center of the machine tool industry in the United States in the same way as the center of population is determined, would locate it approximately on a line passing north and south, just east of Rochester, N. Y. As the tables in this article show, about 55 per cent of the machine tools in the United States are built in New England, New York, New Jersey and Pennsylvania; and 45 per cent are built in Ohio and in the states west of Ohio.

TABLE 2. DISTRIBUTION OF THE MACHINE TOOL INDUSTRY IN THE UNITED STATES

Based upon Number of Men Employed in Machine Tool Shops—Not Including Small Tools—at the Time of the Armistice, 1918

State	Per Cent	State	Per Cent	State	Per Cent
Ohio	27.1	New Jersey	3.2	New Hampshire	0.29
Connecticut	12.1	Vermont	2.9	Maryland	0.27
Massachusetts	10.5	Indiana	2.8	Virginia	0.20
New York	8.9	Michigan	2.7	Missouri	0.18
Pennsylvania	8.4	Kentucky	0.76	California	0.04
Rhode Island	8.3	Iowa	0.58	Tennessee	0.02
Illinois	5.4	Maine	0.53		
Wisconsin	4.4	Delaware	0.43	Total	100.00

Machinery

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BELGIAN STANDARDIZATION ASSOCIATION

The Association Belge de Standardization is a Belgian organization, formed to study the question of standardization from the commercial and technical points of view in all branches of industry. It consists of important industrial and technical associations in Belgium. A general committee has been chosen to direct the activities of the association, to examine any proposals presented, and to keep in touch with similar organizations in foreign countries, in order that the members of the association may profit from results obtained elsewhere, or may, if required, assist in the establishment of international standardization. In each case where the committee decides to attempt standardization, it will appoint a technical committee of experts, who will report, and if necessary consult producers and consumers.

SPRING MEETING OF THE A. S. M. E.

A program that met with the requirements of mechanical engineers engaged in many different activities was arranged for the spring meeting of the American Society of Mechanical Engineers held in Chicago, May 23 to 26, with headquarters at the Congress Hotel. There was an unusually large attendance, and a strong professional program made attendance well worth while. The Western Society of Engineers cooperated wholeheartedly with the American Society of Mechanical Engineers in a session devoted to the subject of "Problems of Chicago as a Midwestern Rail-Water Gateway."

The papers read before the meeting were segregated into a number of different sessions, dealing specifically with fuel, machine shop practice, management, power test codes, railroads, materials handling, forest products, and power. The machine shop session was devoted to four papers dealing, respectively, with the effect of the automotive industry on gear-cutting practice, power press design, lathe design, and interchangeable manufacture. These papers were presented, respectively, by H. J. Eberhardt, H. J. Hinde, R. E. Flanders, and C. B. Lord. The subjects dealt with at the management session were industrial waste and graphics in management.

Excursions were arranged to the International Harvester Co.; Sears, Roebuck & Co.; and the Western Electric Co. At the close of the meeting, an excursion was arranged to the Rock Island Arsenal, which was limited to citizens of the United States not engaged in the manufacture of munitions for a foreign government. This excursion took place May 27 and 28. Friday morning was devoted to the inspection of the arsenal, and the afternoon was given over to a session of the Ordnance Division, at which a paper was presented relating to the needs for munitions preparedness.

* * *

TIME TO BUY COAL FOR INDUSTRIAL PURPOSES

All the authorities on the coal situation agree that unless industrial establishments begin to lay in coal for the coming season at this time, there is likely to be a coal shortage next winter. If no one is putting in any stock now, many industries will find themselves decidedly short in the fall, and all will order at once. If that happens, coal prices will rise again, due to excessive demand. Prices of bituminous coal are reasonable at the present time, and advantage should be taken of the present price level. Furthermore, by ordering coal now, the mines are enabled to work on a steady output, and the demand at no time will rise to a point where excessive prices will be exacted. It is doubtful if there would have been a coal shortage at any time if consumers had laid in a sufficient stock a reasonable time ahead of the actual requirements. Generally, however, the procedure is the reverse. There is a delay in ordering until there is the prospect of shortage, and then everybody orders at once, way ahead of actual requirements—a condition which naturally produces both a shortage and excessive prices.

Automatic Pin Drilling Jig

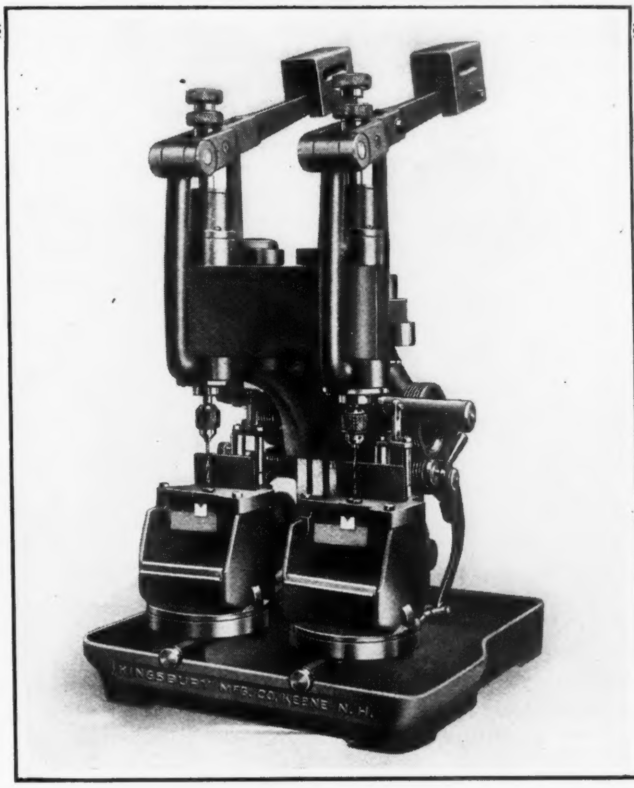

Fig. 1. Machine equipped with Automatic Pin Drilling Jigs

IN the December number of MACHINERY, an illustrated description was published of an automatic sensitive drilling machine which had just been placed upon the market at that time by the Kingsbury Mfg. Co., of Keene, N. H. To adapt machines of this type for the efficient drilling of cross-holes through pins, an interesting type of jig has been developed, and this equipment is here illustrated and described. When the operator pushes the pin to be drilled into place in a V-block, the jig provides for releasing the spindle from its locked upper position, clamping the work in place for drilling, delivering a steady stream of cooling fluid to the point of the drill while the operation is in progress, unclamping the work, ejecting the drilled pin, and relocking the spindle at the top of its stroke until such a time as the next sequence of operations is started.

The way in which these results are accomplished is as follows: The pin to be drilled is held in a V-block *A*, Fig. 2, and when pushed into place in this block, it strikes the end of a screw *B* that is carried at the forward end of a slide *C*. The rear end of this slide rests under a latch *D* that provides for holding the drilling spindle in its upper position until a piece of work is pushed into place. This latch and other auxiliary parts of the mechanism are carried by a plunger *E*, which descends with the spindle. As the drilling spindle starts downward, an eccentric clamping roller *F* comes into action and provides for binding the pin

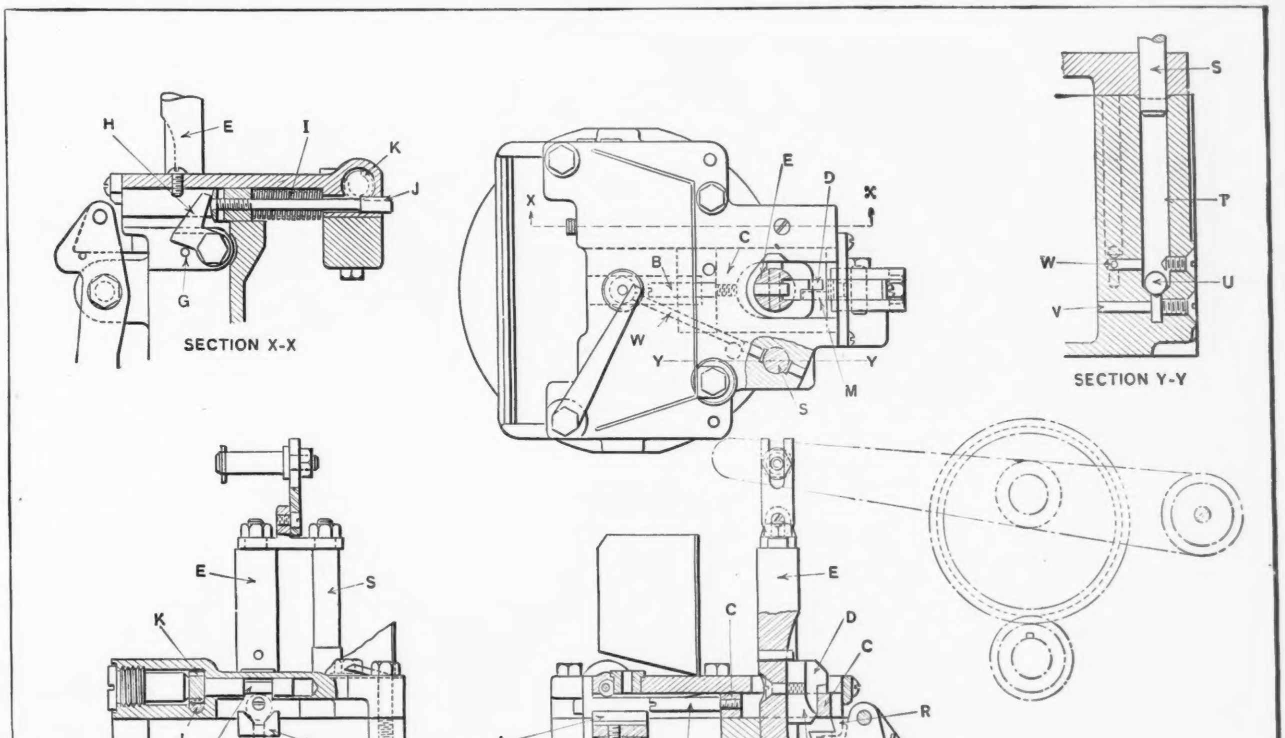

Fig. 2. Details of Design of Mechanism of the Automatic Pin Drilling Jigs shown on Machine in Fig. 1

down in the V-block. This is accomplished in the following manner: A pin *G* carried by plunger *E* drops from beneath a small bellcrank *H*, with the result that compression spring *I* is able to push forward on a plunger secured to the forward end of a rack *J*. This rack meshes with a pinion *K*, carried at the left-hand end of the binding roller *F*, and owing to the eccentricity of this roller, it is able to clamp the work down in place in the V-block *A*.

How the Drilled Pin is Ejected from the Jig

As plunger *E* moves down with the drill spindle, latch *L* strikes the point of a pivoted latch *M*, which swings out of the way to allow *L* to pass. After the drilling operation has been completed and the spindle starts back to its top position, latch *L* engages the under side of *M*, but is unable to pass because latch *M* is prevented from swinging on its pivotal support in the opposite direction through the action of a pin *N*. As a result, the lever *O* swings about its pivotal support *P* against the compression of a coil spring *Q*. This swinging of lever *O* progresses until latch *L* is able to slip past latch *M*; and at that point a shoulder *R* on latch *M* engages the rear end of slide *C*.

Coincident with the return movement of the mechanism, pin *G*, carried by plunger *E*, engages the under side of bellcrank *H* and moves rack *J* backward against the compression of spring *I*. This movement of the rack turns pinion *K* that meshes with it, and by turning the eccentric binding roller *F*, releases the work from the V-block *A*. When this releasing of the work clamp has been accomplished, the compression of spring *Q* swings lever *O* toward the right about its pivotal support *P*, and the shoulder *R* of latch *M* that is then in contact with slide *C* pushes this slide forward so that screw *B* is able to eject the drilled pin from the V-block *A*. At the same time, slide *C* moves into position under latch *D* and locks the spindle at the top of its stroke until such a time as a new pin is pushed into place in the fixture ready to be drilled. It should be noted that the regular automatic cycle of movements of the machine carries the spindle up to a position where latch *D* is slightly above slide *C*, as shown in Fig. 2. Then the spindle starts down, and its movement is stopped by the engagement of latch *D* and the top of slide *C*.

Coupled to the plunger *E* there is a plunger *S* that reciprocates in vertical cylinder *T*, at the bottom of which there is a ball valve *U*. Pipe *V* connects with a reservoir in the base of the machine that contains a supply of coolant. As plunger *S* rises, the suction draws the coolant from the reservoir into cylinder *T*, where it is held by ball valve *U*; and on the next downward stroke, plunger *S* forces the coolant from the cylinder through an outlet pipe *W* which leads to the point of the drill, thus delivering the coolant during the time when the drilling operation is in progress.

Owing to the automatic control of this fixture, one operator is able to attend to a battery of machines that are so equipped, with the result that a very high rate of output can be attained. The actual rate at which pins can be drilled will naturally vary according to the diameter of the pins and the size of the hole to be drilled through them. In drilling holes ⅛ inch in diameter through steel pins ¼ inch in diameter, the rate of production is 1500 pins per hour, which any experienced user of drilling machines will concede to be very satisfactory, taking into account the fact that this production can be easily maintained all day with practically no drill breakage. Fixtures of this type are adapted for use in drilling cross-holes in pins, rivets, screws, etc. It is merely required to push the work into place in the fixture, and so unskilled labor can be utilized.

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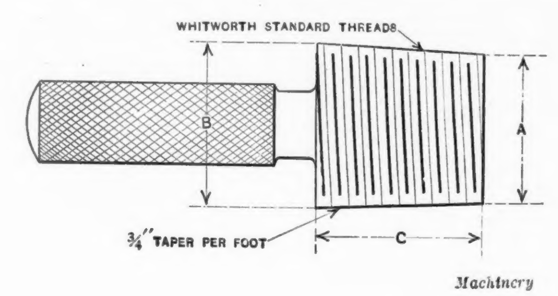
A consular report from India calls attention to the requirements for marking goods exported to India. The principal requirement is that all goods must be marked with the name of the country of origin in letters which are fully as large as any contained in the trademark or description of the goods.

BRITISH STANDARD PIPE THREAD GAGES

By CHARLES HENRICHS
Superintendent, Hollands Mfg. Co., Erie, Pa.

The tables published by the British Engineering Standards Committee on British standard pipe threads do not give sufficient information to enable pipe thread gages to be made with any assurance of accuracy in the dimensions. The tables available in handbooks are directly reproduced from the tables published by the Engineering Standards Committee, and therefore also lack the necessary data for the manufacturer who is called upon to make British pipe thread gages. The writer found it necessary to obtain the necessary information by correspondence with the British Engineering Standards Committee and British firms; and on the basis of the information obtained, prepared the table presented herewith, which will enable anyone to make British pipe thread gages that will meet the requirements.

BRITISH STANDARD PIPE THREAD GAGE DIMENSIONS



Size Inches	A Inches	B Inches	C Inches	Number of Turns in Fitting, by Hand
⅛	0.3730	0.3964	0.375	4 1/3
¼	0.5060	0.5294	0.375	3½
⅜	0.6404	0.6716	0.500	4¾
½	0.8090	0.8480	0.625	3½
¾	1.0180	1.0640	0.750	5¼
1	1.2860	1.3406	0.875	4⅛
1¼	1.6190	1.6815	1.000	5½
1½	1.8510	1.9135	1.000	5½
2	2.3080	2.3783	1.125	6⅞
2½	2.9170	2.9950	1.250	7½
3	3.4090	3.4949	1.375	8 9/10
3½	3.8950	3.9880	1.500	9 6/10
4	4.3870	4.4880	1.625	11
4½	4.8810	4.9885	1.625	11
5	5.3800	5.4890	1.750	12¼
6	6.3640	6.4890	2.000	15⅛
7	7.3650	7.4970	2.125	15⅛
8	8.3560	8.4960	2.250	16½

To the writer's knowledge this is the first table of this kind that has ever been published in the United States, and it is offered because of the need for such a table in mechanical literature.

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A PERMANENT WORLD'S FAIR IN PARIS

The plans for a kind of permanent world's fair at Paris have now come to a point where it seems probable that they will become a reality. The fair, which is to be known as Marché du Monde, will be housed in a building of ten stories with a tower comprising thirty-five floors. The tower will be about 65 feet square and nearly 500 feet high, and will be devoted to offices of those merchants and agencies who do not wish to display their products. It is intended to use the building as a permanent exhibition of the products of the whole world's industries. Further particulars may be had from Milton L. Schmitt, Director American Division, Paris Marché du Monde, Paris, France.

Industry and the Department of Commerce

MR. HOOVER is working out definite plans for making the Department of Commerce of real value to the industries. There is no reason why the Department should not bear the same definite relation and give the same specific service to industry that the Department of Agriculture gives to the farmer.

It is Mr. Hoover's aim to avail himself of all the advice and assistance that he can get directly from the industries. As an entering wedge he is holding monthly conferences with the editors of the leading engineering and trade journals at Washington—the latest was held on May 9—in order to obtain, through this channel, suggestions as to the service which the Department can best render the industries in the respective fields represented by the trade and engineering journals.

Mr. Hoover should have the active assistance and wholehearted cooperation of manufacturers in this work. He has asked Congress for an appropriation of $618,000 in order to establish better service for the industries. The work the Department can do under proper guidance is so important that a sum much larger would be well spent. The amount asked for about equals the cost of a single battalion of our Army. Surely that much should be spent on aiding the industries from which, after all, the great bulk of the income of the Government is drawn.

How can the Department of Commerce be Made a Real Aid to Business?

As the government departments in Washington are now organized many of the functions that belong distinctly in the Department of Commerce are scattered over a number of other departments. A thorough reorganization is necessary if we are ever to have an efficient Government and a Department of Commerce that can serve the industries as they should be served.

The Bureau of Patents, for example, should be under the authority of the Department of Commerce. What could be more important than that such a function as the granting of patents, so directly affecting the industrial progress of the country, should be in the hands of the department directly interested in the welfare of the industries? At present, the Bureau of Patents is far behind in its work, due to faulty organization and insufficient appropriations. The scope of its work should be broadened and new functions added to it. One of these is foreign relations in patent matters. If the Bureau of Patents were part of the Department of Commerce these matters could receive adequate attention.

The Bureau of Patents is but one example of the need for an entire reorganization of the government departments in the interest of economy and efficiency. Everybody complains of the inefficiency of the Government, but few people give any aid to the men who have tried to reorganize the Government on a business basis. Now we have an administration in Washington that is ready and willing to do things on a business basis, and to apply business principles to government. Every man in the industries who believes in a business administration should write his representatives in Congress that there is a demand for better service to the industries, and that such service can only be rendered by a thorough departmental reorganization.

Plan and Purpose of Reorganization

In planning a reorganization, all functions of the Government should be placed in the various departments according to their *use* and *purpose*. The theoretical efficiency engineer is prone to divide an organization according to the *method* that is employed in performing certain work. Thus, for example, someone has proposed that all the engineering work done by the Government should be placed in a single department. This method of subdivision is erroneous. It subordinates the use and purpose of the work to the method by which the work is to be performed, and in so doing would stifle initiative and hamper the service. This applies particularly to the Department of Commerce. If the purpose and use of its service is subordinated to the methods by which the work is done, the entire purpose of the Department for serving the needs of commerce and industry is forgotten.

Functions of a Real Department of Commerce

A Department of Commerce organized to give real service to the industries should comprise every bureau and function at present included as a proper governmental activity that relates to industry, trade, and transportation—domestic or foreign; but it should not include the regulatory functions of the Government, because it must gain the unqualified confidence of the industries, and to do so it should have no regulatory or judicial powers. It should be simply a department of assistance to the industries.

If so organized, it would be possible to build up an intimate contact between the Department and the industries of the country. The Department could obtain and distribute, for the benefit of the industries, statistical data and information relating to problems in the manufacturing field. It could give greater constructive aid in the elimination of waste. It could learn from the industries, through the leaders in the field, what particular service the Department could render that would be of the greatest assistance. It could aid in standardization work whenever the industries indicated to the Department that such work would be desirable. It could publish, without delay, accurate information on conditions in the industrial field with a view to presenting a barometer of business in which the industry could place complete confidence. Such a barometer of business conditions would contain statistics as to production, stocks, percentage of industrial activity, and prices. With able men at the head of the Department and sufficient appropriations to carry on the work, such statistics could be published a few days after the end of each month.

Barometer of Business Conditions

One of the first services that should be established by the Department of Commerce under its present leadership should be an index of the condition of business in general throughout the country. Such an index would be a stabilizing influence. In times of prosperity it would have a tendency to prevent over-expansion and over-speculation. In times of depression it would aid in restoring confidence. It is safe to say that had adequate statistics of this kind been available a year ago, we would not have had the severe depression that followed, and it is equally safe to say that if business knew the percentage of activity that is now going on in the country, in spite of the severe depression in certain industries, the future outlook would be very reassuring. Lacking such a comprehensive barometer of business conditions, we depend haphazardly upon our own opinion and the judgments of some few statistical experts who, in a private way, have undertaken to do for industry what it should do for itself through the disinterested service of a reorganized Department of Commerce.

Let us all get behind Hoover!

New French Tariff on Machine Tools

From MACHINERY'S Special Correspondent

Paris, May 12

BUSINESS in France seems to have improved slightly, but on account of the large stocks on hand, manufacturers find it difficult to dispose of their products, and so the various industries continue quiet. In the iron and steel field, especially, business has begun to improve, and the sales made indicate an end to price cutting. The same may be said concerning machine tools and automobiles. The solution of the German question will certainly stimulate business in general. No appreciable change has been noted in the number of plants shut down.

Changes in Duties on Imports

One thing of moment which has recently occurred was the passing of a law on March 28 increasing the duties on imports. The *Official Journal* published under date of April 3 contains the following modifications in the tariff which will interest the machine tool manufacturers of various countries. The duties are imposed according to the weight of machines and parts, and in order that comparisons may be readily made, it will be remembered that 1000 kilograms are equivalent to 2205 pounds.

Machine tools:

25,000 kg. and up....... 40 francs per 100 kg., instead of 15 francs

5,000 to 25,000 kg......48 francs per 100 kg., instead of 18 francs

1,000 to 5,000 kg.......64 francs per 100 kg., instead of 24 francs

250 to 1000 kg........96 francs per 100 kg., instead of 36 francs

Less than 250 kg.......200 francs per 100 kg., instead of 75 francs

Non-classified machines....40 francs per 100 kg., instead of 15 francs

Iron and steel parts of machines:

Rough parts............ 32 to 56 francs per 100 kg., instead of 12 to 30 francs, according to weight

Finished parts.......... 52 to 100 francs per 100 kg., instead of 20 to 60 francs, according to weight

Tools:

Circular and band saws.140 francs per 100 kg., instead of 53 francs

Hand saws..............100 francs per 100 kg., instead of 38 francs

Files and rasps (finished and rough):

From 35 cm. in length and up............... 120 francs per 100 kg., instead of 45 francs

Less than 35 cm. in length................ 160 francs per 100 kg., instead of 60 francs

Vises and die stocks.... 60 to 180 francs per 100 kg., according to weight

Drills, taps, dies, reamers, milling cutters, etc.... 40 per cent ad valorem, instead of 15 per cent

Calipers, graduated rules, gages and other precision instruments...... 1200 francs per 450 kg.

All the duties given in the foregoing must be multiplied by the general "tariff coefficient" which at the present time is 3. For example, a lathe weighing 900 kilograms will be taxed at the rate of 3 × 96 or 288 francs per 100 kilograms, or a total of 2592 francs. Through the new tariff, prices of machines in France can be readjusted to compare favorably with prices of German machines. For example, a German concern formerly listed a punch and shear having a cast-steel base and weighing 3500 kilograms (7720 pounds) at 30,000 francs ($2514, present exchange), approximately 8.57 francs per kilogram (32.6 cents per pound). This price included a duty of 2520 francs. Under the new tariff the duty becomes 6720 francs, a total increase of 4200 francs ($352), or an increase of 1.20 francs per kilogram, so that the price of the German machine will now be 9.77 francs per kilogram. One French firm quotes 8.10 francs per kilogram for a machine of this type, and another, 11 francs.

Prices of Machine Tools

The value of the stock of machine tools on hand in France, based upon information obtained from the principal dealers, is a billion francs ($83,800,000, present exchange). The highest priced machine tool in stock is a boring and turning mill which is listed at 411,184 francs (about $34,500) F. O. B. warehouse. A lathe, also of American manufacture, having a 15-inch swing and a distance between centers of 4 feet, costs about 12,000 francs ($1000), which amounts to about 13.3 francs per kilogram (50.5 cents per pound). Good French lathes having swings of from 190 to 250 millimeters (approximately 15 to 20 inches) cost about 4.5 francs per kilogram (17 cents per pound) for the largest sizes, and 6 francs per kilogram (22.8 cents per pound) for the smallest.

One German concern has reduced prices to meet the increase in duties on imports. On a small precision machine weighing 120 kilograms and listed at 5000 francs they originally paid a duty of 270 francs. As soon as the new French tariff law was passed, the German firm announced that it would reduce the price of the machine to 4000 francs. Including the new duty, the total cost will now be 4720 francs instead of 5270 francs, which it would cost if the price had not been reduced.

Prices of Raw Materials, Wages, and Living Costs

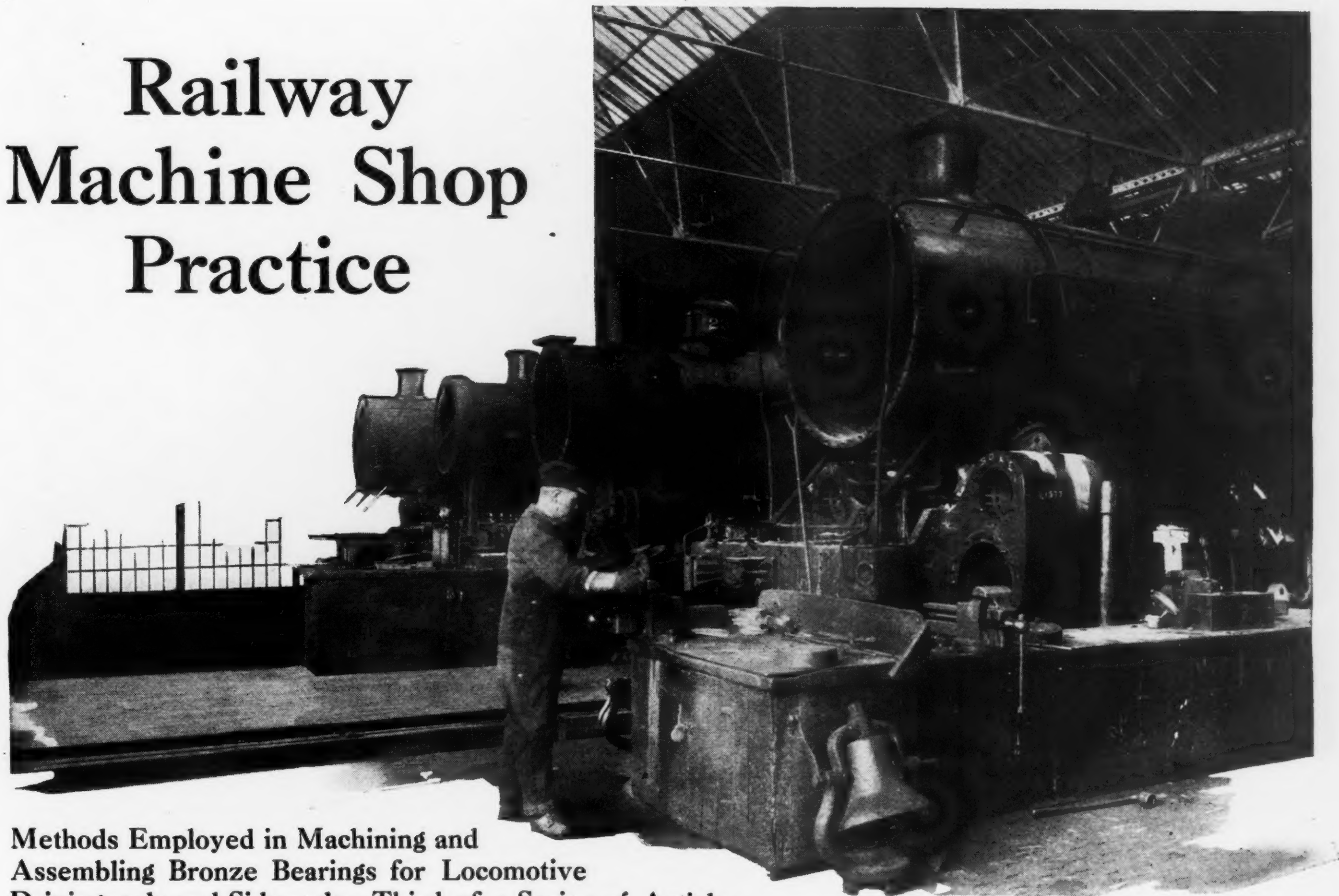
Metals have undergone another considerable cut in price, the permission to sell coal and coke for other than blast furnaces being largely responsible for this. Pig iron is listed at from 270 to 280 francs per metric ton ($20.37 to $21.11 per English ton, present exchange). Steel bars sell at from 65 to 70 francs per 100 kilograms ($49.05 to $52.83 per English ton). The protection given by the customs department in raising the duty on steel bars and sheet steel will tend to stabilize prices in France; prices are now stable in Belgium.

The cost of living has decreased materially due to governmental action, the reduction since the beginning of the year amounting to from 25 to 30 per cent; and it is believed that a still further reduction will occur during the next few months. Wages have been reduced proportionately; in the iron ore mines at Longwy an earlier reduction of a franc per day (8.38 cents), has just been followed by an additional reduction of 1.5 francs per day. At Rheims all working people have had their wages reduced from 10 to 20 per cent.

Union of Two Steel Concerns

Les Forges et Acieries du Nord et de l'Est has just united with the steel works of Basse-Loire and this combination constitutes one of the most important of the French iron and steel companies. The plants which it comprises are spread over the north, east, and west of France. The mining properties which it controls include an estimated reserve of more than 350,000,000 metric tons of mineral.

Railway Machine Shop Practice



Methods Employed in Machining and Assembling Bronze Bearings for Locomotive Driving-rods and Side-rods—Third of a Series of Articles

IT is a matter of general mechanical knowledge that the practice of bushing bearings with a bronze alloy is followed in the construction of driving-rods and side-rods for use on locomotives. There is a fundamental difference in the design of these bearing boxes, namely, the outside of the driving-rod box is of rectangular shape, while the side-rod box is of cylindrical form. The usual method of procedure in machining both of these types of brasses is to first finish the outside, after which they are assembled in the rod and then set up on a suitable form of boring machine to provide for finishing the inside diameter.

Planing the Outside of a Driving-rod Brass on the Slotter

In Fig. 1 there is illustrated a slotting machine built at the Niles Tool Works of the Niles-Bement-Pond Co., in Hamilton, Ohio, which is shown in operation in the Chicago, Rock Island & Pacific Railway Shops at Silvis, Ill., engaged in planing the outside of a bearing brass for a locomotive driving-rod. Conforming with usual practice, this brass is flanged, so that the strap which holds it in place on the end of the driving-rod fits into channels that preclude the possibility of the brass slipping out of place. In performing the required planing operations on this slotter, the edges and inner sides of the two flanges can be planed, as well as the outside walls of the brass.

One advantage of a slotter for work of this kind is that the swiveling table makes it possible to finish four sides of the brass at two settings. After all surfaces on one side of the brass have been planed, the table is indexed through 180 degrees, after which the same work is done on the opposite side. Then the brass must be removed from the table and reset to provide for planing the corresponding surfaces on the two remaining sides. To afford clearance between the under side of the work and the slotter table, so that the tool can cut down to the bottom of the work, a practice is made of setting the job up on blocks *A* which raise it sufficiently to give the desired working conditions.

In railroad shops engaged on work connected with the maintenance of locomotives, the machining of bearing brasses for driving- and side-rods is one of the most common operations. This article describes methods used in three well-known railroad shops for the execution of work required in refinishing used brasses or machining new castings—the Chicago, Rock Island & Pacific Railway, the Chicago & Northwestern Railway, and the Illinois Central Railroad.

Planing the Outside of a Small Driving-rod Brass on a Shaper

In Fig. 2 there is illustrated a 24-inch shaper built by Gould & Eberhardt, Newark, N. J., which is equipped with an indexing fixture to provide for planing the side walls and the flanges of various sized driving-rod brasses. This method is used in the Chicago & Northwestern Railway Co.'s shops in Chicago, Ill. For work that comes within its range, such an equipment possesses an advantage over the use of a slotter tooled up as shown in Fig. 1 in that the whole job can be completed at a single setting. So far as the actual planing operation is concerned, it is of an extremely simple character, consisting merely of the planing of straight, horizontal, and vertical surfaces on the flanges and on the side walls of the bearing brass.

However, the fixture is of sufficient interest to call for a brief description. As will be seen, there is a faceplate *A* pivoted to the body *B* of the fixture; and extending through the flange of the fixture body into the back of the faceplate, there is an index-pin *C*. This pin enters one of several holes that are provided in the back of the faceplate for securing the work in various positions in which it must be held for performing planing operations on different sides of the bearing brass. Faceplate *A* is pivoted to the body *B* of the fixture by means of bolt *D*; and after the index-pin *C* has entered the hole

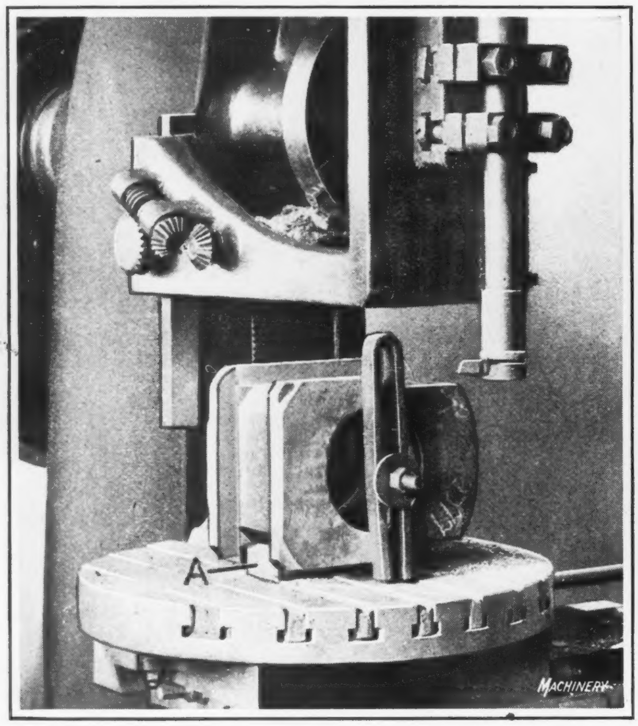


Fig. 1. Slotter equipped for performing Planing Operations on a Driving-rod Brass

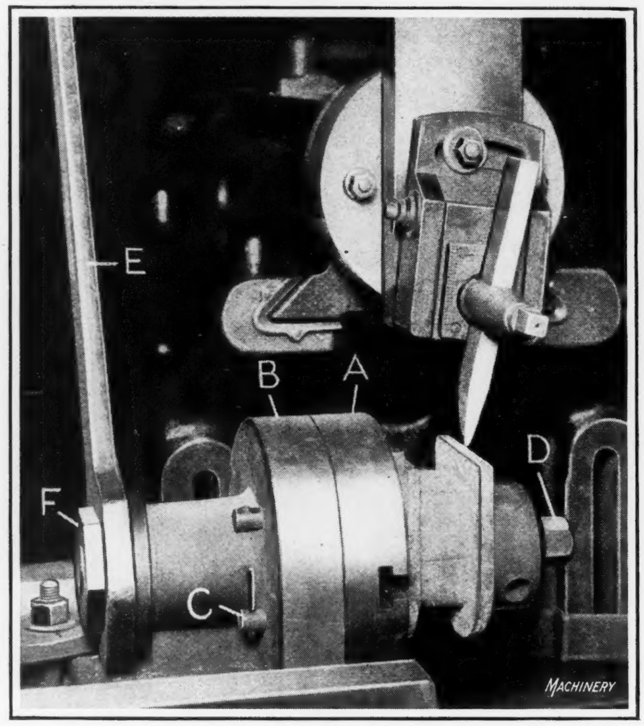


Fig. 2. Shaper equipped for performing Planing Operations on a Driving-rod Brass

to give the required location, a long handled wrench E is utilized to tighten the nut F on the end of the bolt D, which secures the work firmly in place.

Boring the Inside Diameter of a Driving-rod Brass

Previous mention has been made of flanges furnished on the outside of the driving-rod brasses, to enable a strap to secure the brass firmly in place on the rod. In the Chicago & Northwestern Railway Co.'s shops, a practice is made of utilizing this driving-rod strap as a jig, in which the brass is held while performing a boring operation on the inside diameter. In Fig. 3 there is shown a vertical boring machine built in the Niles Tool Works of the Niles-Bement-Pond Co., which is engaged upon the performance of this operation. So far as the boring operation is concerned, it is perfectly simple, consisting of the use of a boring-bar A for taking a cut over the inside diameter, and a tool B on the second turret face, that is utilized for facing the side of the brass. In order to provide the necessary clearance between the under side of the work and the boring machine table to allow the tool to cut down to the bottom of the brass, it will be seen that the work is set up on parallel strips C and that it is held down on the boring mill table by means of straps D.

Fig. 3. Use of a Driving-rod Strap to hold the Bearing Brass while performing a Boring Operation

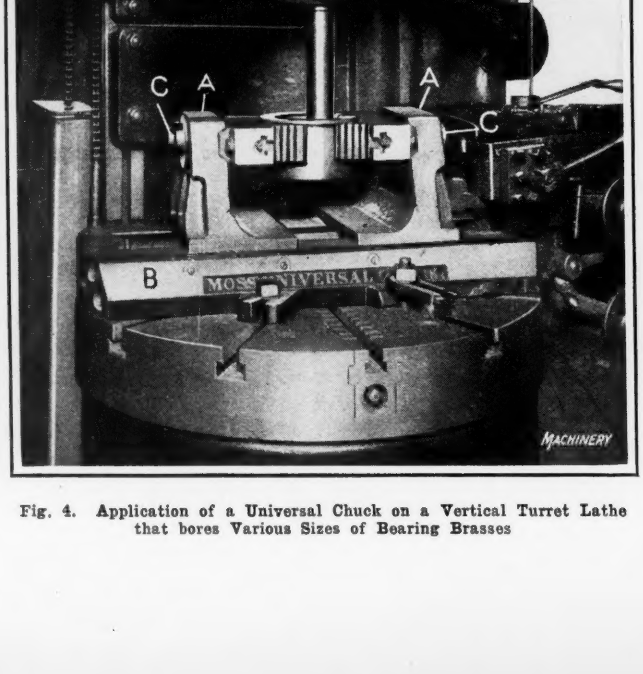


Fig. 4. Application of a Universal Chuck on a Vertical Turret Lathe that bores Various Sizes of Bearing Brasses

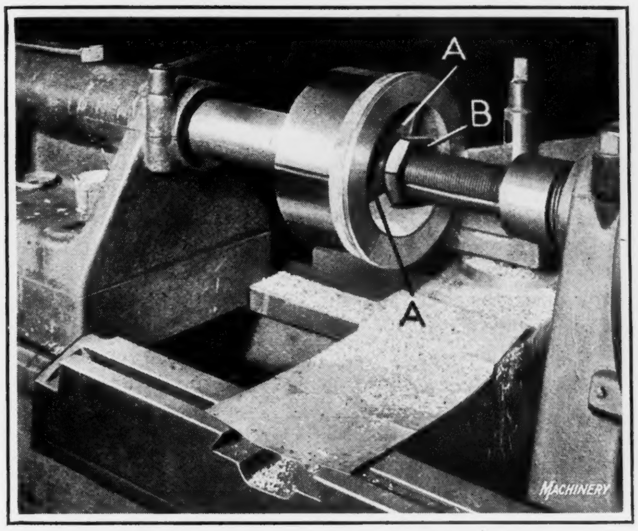


Fig. 5. Screw-operated Expanding Mandrel for holding Side-rod Bearing Brasses for turning

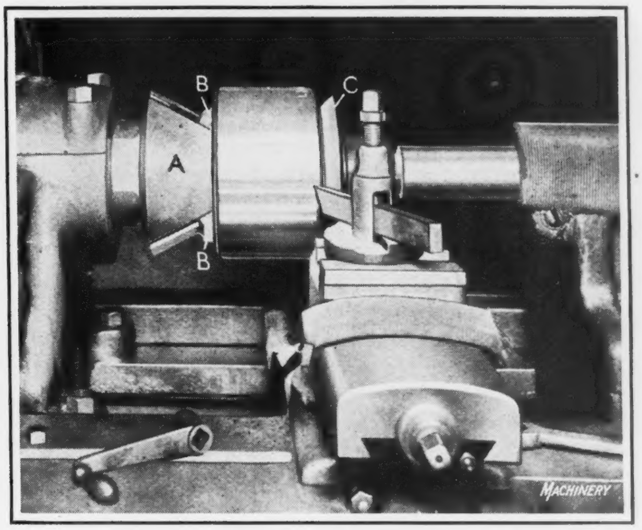


Fig. 6. Special Centers for holding Side-rod Bearing Brasses during the Turning Operation

Boring Side-rod Brasses

Previous mention has been made of the fact that it is quite general practice in the machining of side-rod brasses to first finish the outside, and after pressing the brass into place in the rod, to set the work up on a boring machine to provide for finishing the inside diameter of the bearing. In Fig. 4 there is illustrated a method used in the Burnside shops of the Illinois Central Railroad Co. in Chicago, Ill., which represents a departure from this procedure. It will be seen that a vertical turret lathe built by the Bullard Machine Tool Co., of Bridgeport, Conn., is furnished with a Moss universal chuck in which the previously turned bearing brass is held during the performance of the boring operation.

Bearing in mind that the two ends of the brass have to be faced, in addition to turning the inside diameter, it will be apparent that this universal chuck which is mounted on pivotal supports so that the work may be turned over, provides a convenient means of enabling the entire job to be completed at a single setting. On this machine, the turret carries the usual sequence of tools used for the performance of successive boring and facing operations; and it will be evident that the two chuck jaws are carried by supports *A* which slide on a bed *B*, adjustment of the opening between the jaws being accomplished by sliding the supports on the bed by means of a screw. As shown, the jaws are pivoted at *C*, so that they may be swung over to bring the lower side of the work into the operating position.

Arbor for Holding Side-rod Brasses while Turning

Fig. 5 illustrates a special threaded mandrel used in the shops of the Chicago, Rock Island & Pacific Railway at Silvis, Ill., for holding side-rod brasses while turning the outside diameter. From the illustration it will be seen that there are three jaws, two of which are shown at *A*, which grip the inside of the work. These jaws are parallel to the axis of the mandrel on their outer edges, but the inner edges are tapered and slide in inclined grooves cut in the threaded mandrel for that purpose. After the work has been slipped over the jaws, nut *B* is turned toward the left, causing the tapered inner edges of the jaws to ride upward on the inclined grooves in which they are carried, thus expanding the jaws and causing them to secure a firm grip on the inside of the work. There is nothing unusual about the actual turning operation performed on the outside of the bearing brass.

Special Chuck for Holding Side-rod Brasses while Turning the Outside Diameter

In Fig. 6 there is illustrated another means of holding side-rod bearing brasses while turning the outside diameter. This consists of a special pair of centers or, more properly, of a special chuck and an outboard center, between which the work is held. It will be seen that in the live spindle of the engine lathe there is mounted a chuck or driving center *A* in which there are three jaws (two of which are shown at *B*). These jaws are stepped to enter different sizes of bearing brasses. In this illustration, the brass is in place on the top step of the jaws *B*. On their inner edges, the jaws are tapered and engage inclined grooves cut in the chuck body. After the bearing brass has been put into place over the jaws, the outboard center *C* is tightened up against the work, thus causing the three jaws *B* to ride upward on the tapered grooves in the chuck body, and secure a firm grip on the inside of the casting. This chuck is used in the shops of the Chicago & Northwestern Railway Co. in Chicago.

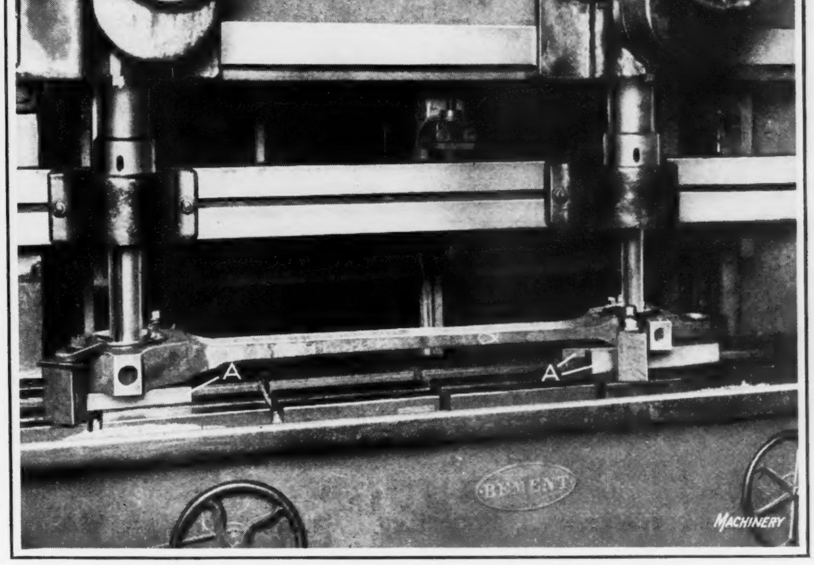


Fig. 7. Duplex Boring Mill for boring Side-rod Bearing Brasses after they are pressed into Place

Setting up Side-rod Brasses for Boring

The usual practice in handling work of this kind in the shops of the Chicago & Northwestern Railway Co. is to turn

the outside of the side-rod bearing brasses, then to use a hydraulic press to force them into place in holes bored in the rod for their reception, and finally to send the assembled rod to a boring machine to provide for finishing the inside diameter of the bearings. Fig. 7 illustrates a duplex boring mill built at the Bement-Miles works of the Niles-Bement-Pond Co., in Philadelphia, Pa., which enables both bearing brasses to be bored simultaneously. It will be seen that the work is set up on two parallel bars *A* at each end of the rod, which raise the lower end of the brasses sufficiently to provide clearance for the boring tools between the table and the work. The rough-boring tools consist of arbors set in the spindles of the machine and carrying fly cutters with which the preliminary cuts are taken, after which intermediate and finishing cuts are taken with tools of suitable forms. It is the method of setting up work and the provision made for boring both bearings at the same time that are of interest, rather than the actual procedure in performing the boring operations.

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PREPARING AUTOMOBILE BODIES FOR PAINTING

In the accompanying illustration, there is shown a Type H-7 portable, electrically driven equipment built by the R. G. Haskins Co., 27 S. Desplaines St., Chicago, Ill. It is illustrated in use in an automobile body building plant, where this machine is used to drive a stiff wire scratch-brush that is employed to slightly roughen the aluminum surface, so that the paint will adhere tightly to the metal.

Use of Electrically Driven Scratch-brush for preparing Motor Car Bodies to receive their First Coat of Paint

It will be noticed that the whole outfit is mounted on a truck which facilitates moving from one job to another. The equipment consists of a 1 horsepower motor with a three-speed countershaft that gives spindle speeds of 900, 1800, and 3600 revolutions per minute. Six feet of flexible shafting connects the scratch-brush with the driving motor.

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A noticeable development of German activity in China is being recorded. Considerable quantities of German manufactured goods, including electrical machinery, and iron and steel products, are becoming factors in the China market.

SOURCES OF INDUSTRIAL POWER

In considering the world's future supply of power for industrial and other purposes, there are three main resources that are of importance—the water power in the world's rivers and the fuel supply in the form of coal and oil. Investigations have been made to determine exactly what the world's inventory is in these means of power supply. A review of the water power resources of the world has been prepared for publication by the United States Geological Survey. It shows that only about one-twentieth of the possible water power of the world's rivers has been utilized. One-half of the utilized water power is in North America and one-third in Europe. In water power resources as yet undeveloped, however, Africa ranks first, having over 40 per cent of the world's supply. Second place is taken by Asia; third by North America; fourth by South America; and fifth by Europe.

The coal resources of the world are very unevenly distributed between the various continents. Of these resources, especially when the better grades of coal are considered, North America has more than one-half; Asia about 25 per cent; and Europe about 17 per cent. Very little coal, comparatively speaking, is found in Australia, Africa, and South America. Estimates have also been made of the world's probable supply of petroleum oils, upon which we depend for our supply of gasoline, kerosene, and numerous other similar products. There are greater oil resources in North America than in any other one continent. Asia has also large oil supplies, with South America, Europe, Australia, and Africa following in the order mentioned. In each of these continents the oil is found in a comparatively small area, so that it is estimated that about 4 per cent of the earth's surface contains about 60 per cent of the world's total oil supply.

If we take fifty million horsepower as the average figure for the water power of the United States, susceptible of development without storage of water, we find that with the average power requirements of today, our rivers and streams, if fully developed and used, would just about meet the country's present needs and would supply that amount of power for all time to come. Moreover, with proper storage of water and improved load factor, the country's water supply would provide a considerably increased output of energy to meet a growing demand. If, on the other hand, the whole burden were placed upon the coal mines, and the water power already developed were not used, it has been estimated that by adopting the best steam practice of today, the present power requirements of the country could be met by available coal resources for 57,000 years.

This figure becomes all the more striking and has considerable instructive value when we turn our attention to the available oil resources of the United States. Were all the power of the country derived from the use of fuel oil, by adopting the best possible practice known today for the economical use of fuel oil in the production of steam, we would find that the known oil resources of the United States would last only nine years and three months. A comparison of the total resources available in coal and oil, therefore, makes it possible to appreciate the general truth of Eckel's statement in his recent book "Coal, Iron and War," in which he says: "We have just as much real chance of replacing coal by oil as we have of finding enough gold to use in place of steel."

The figures given also indicate that unless a check is placed upon the increase in the consumption of oil, the available oil resources will soon be exhausted. The resources of natural gas have already, in many instances, been depleted, and the same process is now being applied to the oil resources. A more extensive use of water power is to be expected within the near future. Water power development, of course, requires large investments, but when this investment has once been made, the power output continues for generations.

PREMIUM AND PIECE-WORK SYSTEMS

By I. O. PERCIFIELD

Judging from the various opinions that are expressed on the subjects of "premium" and "piece-work," there is apparently no general or uniform understanding of the merits of these systems. To understand the advantages obtained from premium or piece-work systems, it is necessary to analyze the reasons why they are used and to consider with an unprejudiced mind the objections given for not wanting to work under them.

The Object of Premium and Piece-work Systems

First, it must be understood that the main object of premium or piece-work systems is to increase the efficiency of a plant. A higher rate of efficiency necessarily means increased production, lower operating costs, and a reduction in the amount of material and labor used. It is not necessary to explain in detail the effect premium or piece-work has upon the efficiency of a plant. However, it is well to remember that a properly controlled system automatically regulates the discipline of the employes, and functions in a manner that will produce the results mentioned. Where a premium or piece-work system is properly installed, there is no time allowance on defective work, and no operations are done on parts made defective by previous operations until the defective work has been salvaged and O. K'd by the inspector. All work should be inspected and counted after each operation, allowing premium time for those parts passed by the inspector.

It will be understood from the foregoing why premium and piece-work systems are used, but why do a great many employes object to working under these systems, and what reasons do they give? Are these reasons based on facts or imagination? Can the causes of these objections be eliminated successfully without lowering the efficiency of the system? These questions have been asked and answered in different ways by managers and efficiency engineers who have made a study of the subject while endeavoring to work out a general plan involving certain principles that could be used successfully in the majority of manufacturing plants.

Methods of Creating Interest on the Part of Employes

It has been shown in many instances that the primary cause of the employe's objections to working under premium or piece-work systems is lack of interest. Since lack of interest is the primary cause, the first thing to do is to build up a system that will create interest. There are several ways by which interest can be created. Some methods are better adapted for use in one shop than in another, and it remains for the individual manager or engineer to find the one best adapted to his own needs.

One plan that has been used successfully is the offering of a prize at the end of certain periods to the operator having the best record in each department. The prizes may consist of money or something else. Under this plan the records of all employes are posted at the end of each period in the form of bulletins in the departments in which they are employed. This acts as an incentive to the naturally industrious workmen and a spur to the indifferent. The bulletins give the punctuality, defective work, attendance, and production record of each operator in the department for the period just passed.

Gaining the Employe's Confidence

Another of the principal objections to working under the premium and piece-work systems is the idea that the operator is giving a greater value to the employer than he is rewarded for—in other words, there is a lack of confidence. The idea that the "hire and fire" method is the best way to get results from employes has been proved to be erroneous. A mutual understanding between employer and employe that any grievance shall be quickly and openly adjusted, according to written rules or instructions, tends to create confidence, which is essential to the efficiency of any organization.

One of the best ways to produce results quickly is through the department foreman. He must be capable and thorough, and command the respect and confidence of his men. His influence will prove of great value if properly exerted. He should be able to teach his men better methods and show them how to improve. By this means, the men through their foreman, will gain confidence in the firm.

The practice of lowering rates arbitrarily has been the cause of more unrest and mistrust among employes of premium-operated factories than any other factor. By using a systematic method of regulating rates that is understood by both employer and employe to be fair, there will not be any complaints. The method used should automatically adjust any over-rated or under-rated operation. The establishing of cooperation between employer and employe by this method will insure satisfactory results to both.

Need for Instructing Employes Concerning Underlying Principle of Premium and Piece-work Systems

The writer had occasion to ask an operator in one of the large factories of the Middle West if he was working piece-work. The operator replied very emphatically that he was not, and wouldn't work piece-work for any firm, adding "I do more work now than what I get paid for." This operator was not speaking from any definite knowledge he had attained in working under a piece-work system. His reply only expressed the sentiment of thousands of other employes, who, like him, had never analyzed their positions with sufficient care to know whether piece or premium work would be to their advantage or not.

In fact, this operator was working under the principle of premium work and did not realize it. Everybody who works for wages or salary necessarily works for a premium. All must produce some result, either by manual labor or by the application of personal knowledge that is of value, before any reward is received. We are paid for something given. Upon how much or what we give depends the value of the reward. Suppose some of us do not produce the results for which we are paid—should we expect to receive the reward just the same as those who do? The majority of factory employes are honest and want to be fair in their dealings with their employers, but the practice of cutting rates arbitrarily, and ignorance of the real value of the premium and piece-work system to the employe, has caused a great many to become prejudiced against these systems. By proper instruction, this prejudice can be overcome and interest created that will eventually make premium and piece-work just as popular with all employes as it is now with a few.

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AN EXAMPLE OF DECREASED PRODUCTION

The Boston Chamber of Commerce, having investigated the building situation, found that in 1898 a bricklayer and his helper laid 1500 bricks in an eight-hour day at a cost of 35 cents a hundred bricks. Last summer the rate was 500 bricks a day, at a cost of $2.72 a hundred bricks, or nearly eight times as much. It is of little consequence how many dollars and cents is a day's wage, but it matters a great deal what the product of labor is in any one day. No more can be bought and enjoyed than is produced, and low production means a low standard of living for labor, even though wages may be advanced tremendously. Russia has shown the truth of this statement. The reason why the standard of living in the United States has always been higher than elsewhere is because labor has always produced more per day in the United States than elsewhere. If the rate of production is decreased, the real rate of wages, as measured by their purchasing power, cannot possibly increase.

American Gear Manufacturers' Convention

THE fifth annual meeting of the American Gear Manufacturers' Association, held in Cincinnati, April 27 to 30, was characterized by the intensive application to business and the accomplishment of results that has always been the keynote of the conventions of this association. The program laid down for the four days of activity was a comprehensive one, including several valuable addresses, a number of standardization reports, and discussions dealing with gear manufacturing practice. The association, which was founded only a little over four years ago, has now 92 member companies, with in all 109 executive members and 55 associate members. At the Cincinnati meeting, the Baush Machine Tool Co., Springfield, Mass.; the Cincinnati Gear Cutting Machine Co., Cincinnati, Ohio; and the Medart Patent Pulley Co., St. Louis, Mo., were elected members. Ever since the foundation of the association, F. W. Sinram, of the Van Dorn & Dutton Co., Cleveland, Ohio, has been president; H. E. Eberhardt, of the Newark Gear Cutting Machine Co., Newark, N. J., vice-president; and Frank D. Hamlin of the Earle Gear & Machine Co., Philadelphia, Pa., secretary. B. F. Waterman of the Brown & Sharpe Mfg. Co., Providence, R. I., has acted as chairman of the standardization committee.

Importance of Organization in Industry

In his opening address, Mr. Sinram, the president, pointed out the necessity for organization in industry, saying that "without organization you have no industry," and pointing out that this statement was perhaps more true today than ever before, because never before had cooperation between those engaged in the same field of endeavor been so important as it is today. He emphasized that we are now returning to a normal industrial condition, but the normal of tomorrow will not be the normal of yesterday. We are facing vastly changed conditions; quoting Forbes, Mr. Sinram said that "good times for all can only be had by the product of good work by all." It is the collective effort that counts. As a sequence to the times that have passed, there has arisen on every hand—and rightly so—a demand for better products. One of the means toward a better product in the gear industry is to be found in the standardization efforts of the association—technical, commercial, and cost accounting. The latter item, particularly, is important at this time, as it is only by the solution of the problem of how to avoid destructive competition that real progress can be made in the industry. Mr. Sinram also referred to the importance of production statistics and said that the industry ought to have such statistics in order that the individual members might be guided thereby.

Standardization Work of the Association

The standardization of the work of the association at the present time includes efforts toward arriving at specific standards for spur gears for industrial gearing; for regular and spiral bevel gears; for herringbone gears; for hardening and heat-treating, including classes of steels to be used in gear-making practice; for inspection of gearing; for keyways; and for sprockets. A number of other standardization committees are also working on definite standardization problems, and will submit reports of their findings at future meetings. The association also works in conjunction with the American Engineering Standards Committee in an effort to establish national standards.

Part of the recommendations made by the committee for the standardization of spur gearing were referred back to the committee for further consideration, but the following items relating to the standardization for industrial spur gearing were adopted as recommended practice:

The width of face for industrial spur gearing shall be 10 divided by the diametral pitch. It is recommended that the following table be used for convenience, as closely adhering to this formula:

Diametral Pitch	Face, Inches	Diametral Pitch	Face, Inches	Diametral Pitch	Face, Inches
1	10	2¾	3¾	8	1¼
1¼	8	3	3½	10	1
1½	7	3½	3	12	¾
1¾	6	4	2½	14	¾
2	5	5	2	16	⅝
2¼	4½	6	1¾	18	½
2½	4	7	1½	20	½

Machinery

The thickness of rim for spoked spur gears for industrial work is recommended to follow the formula: Rim thickness $= 4 \div$ diametral pitch (or $= 1.3 \times$ circular pitch). The diameter of hub for spoked spur gears for industrial work is recommended to follow the formula: Diameter of hub $= 2 \times$ diameter of bore.

A report made by the bevel and spiral bevel committee was adopted as recommended practice. The recommendations contained in this report will be published in a coming number of MACHINERY. The report of the herringbone gear committee was referred back to the committee for further consideration, as was also the report of the keyway committee. The reports of the inspection standardization committee and of the hardening and heat-treating committee were accepted as recommended practices, and the important features of these reports will be covered in a future number of MACHINERY. Progress reports were also presented by the committee on gears and pinions for electric railways and mines and by the committee on sprocket wheels, as well as reports by the committees on uniform cost accounting; commercial standardization; labor; worm, worm-gears, and spirals; and composition gearing.

Addresses Made before the Convention

Addresses were made before the convention by J. B. Doan, president of the American Tool Works Co., Cincinnati, Ohio; by Edward S. Jordan, president of the Jordan Motor Car Co., Cleveland; Ohio; and Charles Woodward, vice-president in charge of personnel, Hydraulic Pressed Steel Co., Cleveland. Papers of a technical nature were read by G. M. Bartlett of the Diamond Chain & Mfg. Co., Indianapolis, Ind., on the "Ideal Chain and Sprocket Drive"; by A. R. Mitchell of the Andrews Steel Co., Newport, Ky., on "Industrial Gears from the Users' Standpoint"; and by J. B. Foote, president Foote Bros. Gear & Machine Co., Chicago, Ill., on "Worm-gearing." The latter paper pointed to some definite developments in the methods of calculating the strength of worm-gearing, which will place this obscure subject upon a more rational basis and make it possible for manufacturers to get more accurate data in regard to strength calculations for worm-gear drives.

The following officers were elected for the coming year: President, F. W. Sinram; first vice-president, R. P. Johnson; second vice-president, B. F. Waterman; and secretary and treasurer, Frank D. Hamlin. The following members of the executive committee were elected: F. W. Sinram, H. E. Eberhardt, Frank D. Hamlin, A. F. Cooke, B. F. Waterman, and C. E. Crofoot.

HOBBING SCROLL CHUCK JAWS

By CHARLES O. HERB

A novel method of machining the teeth on jaws for scroll chucks was devised by the machine designer of the Philadelphia Engineering & Machine Co., during the development of the Sacrey vertical oil-groover. This machine is provided with a scroll chuck for holding bushings or other parts to be grooved in a vertical position. At first it was intended to furnish a chuck of standard make, but the small hole in commercial chucks of the desired size, made their use impossible. It was finally decided that the firm could manufacture just the chuck it required at a considerably less cost than if it were made special by an outside concern. This was done through the use of an ingeniously constructed hob for producing the teeth in the chuck jaws.

A detail drawing of the jaws furnished on the chuck, which gives an idea of their size, is illustrated in Fig. 1. The teeth are 5/32 inch in height, and the distance from center to center of each tooth is 0.175 inch. There are approximately twenty-five teeth on each jaw. The hob used in cutting these teeth is shown in Fig. 2 mounted on a Rockford horizontal milling machine, the over-arm and arbor support being removed from the machine. A jaw is clamped on the table and the teeth are cut as the jaw is fed past the revolving hob, only one traverse of the work being necessary to cut the teeth to the required depth. The jaws are annealed before this operation, and pack-hardened after they have been completely machined. As the jaws are fed past the hob at the rate of 3½ inches per minute, the cutting time is slightly more than 1¼ minutes.

Reference to the illustration will show that the hob greatly resembles a scroll, one continuous groove having been milled spirally on its face, the pitch of the groove being, of course, 0.175 inch to correspond to that desired on the jaws. In cutting this groove, the hob was mounted on the same milling machine and in the identical manner illustrated. A single-point tool held in an Armstrong toolholder secured to the table was set for cutting the groove to the required depth, being fed past the rotating work at the rate of 3½ inches per minute. The hob was revolved at the rate of twenty revolutions per minute in order to obtain the desired thread pitch. Thirty-six flutes were then milled radially across the face to produce cutting edges and chip clearance.

Prior to cutting the groove, the face near the rim was tapered, so that on the finished hob, the first few outer rows of teeth take roughing cuts on the jaws while the remaining teeth are for finishing. After having been machined, the hob was hardened and tempered, and the cutting edges of the teeth were ground. It will be apparent that these cutting edges can be reground from time to time as necessary. The outside diameter of the hob is 9 inches and the thickness is 2 inches. The diametral distance between the inner edges of the teeth is such that there is

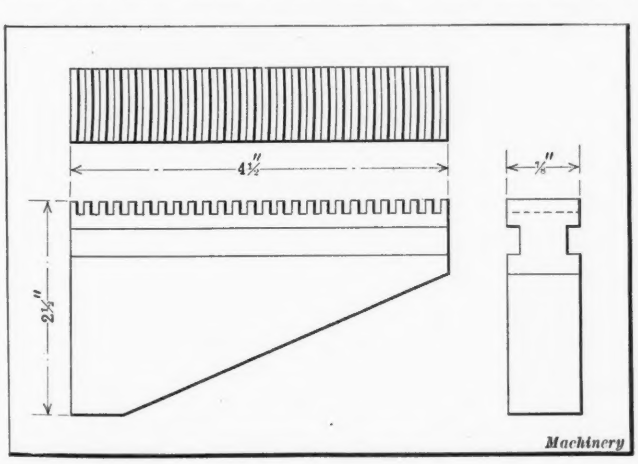


Fig. 1. Detail Drawing of Jaws used on Scroll Chuck of Oil-groover

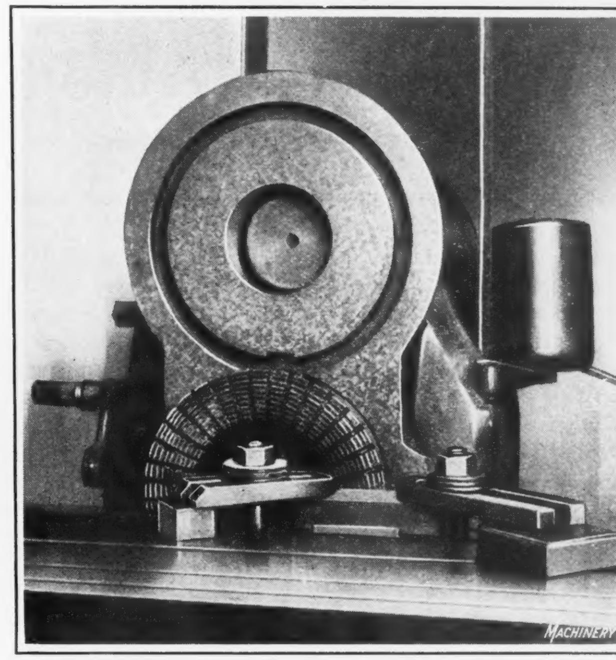


Fig. 2. Employing a Specially Designed Hob for machining Teeth on Chuck Jaws

sufficient space for the entire length of a jaw to pass the innermost cutting edge of the hob without coming in contact with a cutting edge diametrically opposite.

* * *

INCREASE IN WAGES DUE TO USE OF MACHINERY

Labor, on various occasions has opposed the use of labor-saving machinery, because of the belief that labor-saving machinery would reduce wages and decrease the opportunities for work. The whole history of industrial development has conclusively proved that the opposite has been the result—that wages have been increased and that the number of people engaged in industrial work has become greater. The use of machinery makes it possible to produce more with the same amount of work. As the production is increased, wages can also be increased; and when wages are increased, the consumption of manufactured goods is increased, creating a greater demand. This, in turn, necessitates the employment of a greater number of men in the industry, so that the use of machinery, instead of decreasing, increases not only production but also the opportunities for work.

Industrially, the United States and England are the leading countries in the world today. In the United States three times as much mechanical horsepower is employed per worker as in England, and because we use a greater amount of mechanical power, the production per man in the United States is 2.6 times as great as the average production per man in Great Britain, while the value of the output per wage earner is twice as great.

* * *

STATUS OF PATENTS GRANTED TO GERMAN INVENTORS

The status of patents granted to German subjects by the United States Patent Office prior to the declaration of war by the United States in 1917 has not changed unless the patents have been seized by the Alien Property Custodian, or licensed under the provisions of the Trading with the Enemy Act. Information regarding the seizure of patents can be obtained by communicating with the Alien Property Custodian, Washington, D. C., and identifying the particular patents about which information is desired. Inquiries regarding patents which may have been licensed should be directed to Federal Trade Commission, Washington, D. C.

When Does Automatic Machinery Pay?

By ALBERT A. DOWD, President, Albert A. Dowd Engineering Co., 131 W. 39th St., New York City

THE development of automatic machinery in the last twenty-five years has been remarkably rapid, yet, at the same time, manufacturers in general are reluctant to experiment with it. They are glad to pay a visit to some progressive factory near at hand, and will examine with interest a number of automatic machines, working steadily, and delivering a uniform product regularly, without requiring much attention. They may feel convinced that these machines are money-savers for their owners, but it would be difficult to make them see that something of the same nature would be economical if used in the manufacture of their own product. Considering that a given manufacturer has an idea of installing automatic machinery for a certain operation on his product, and that he has called into consultation a well-known automatic machine designer, the following points would naturally come up for discussion:

1. Can an automatic machine be designed which will give the desired results, and which can be depended on to turn out a thoroughly satisfactory product?
2. How much will it cost?
3. What production rate will it give?
4. How much attention will it need to keep it in running order?

Now let these points be taken up in the order named, considering the matter from the viewpoint of economy to the manufacturer.

Will an Automatic Machine do the Work?

The most successful automatic machines imitate the operations and motions which an operator's hand accomplishes. Frequently there are fingers of metal on the machines, and these are ingeniously operated by means of cams and levers, so that their action is very similar to that of the hand. Occasionally there are hand operations on a product which at first glance appear difficult to perform by means of machinery: To the uninitiated it would seem difficult to put a knot in a piece of string by machinery, and yet this is done every day and by various kinds of machinery. The making of paper boxes and packages of different shapes and sizes is an automatic process, and there are hundreds of delicate operations in the counting, packing, and sealing of various products, which are performed automatically in hundreds of factories throughout the country.

A capable automatic machine designer will go through a factory and watch the operators at work. He will note every detail of the processes used, and will plan his automatic machines along the general lines of the hand operations, making improvements wherever possible. It is possible that some of the operations may be such as to require considerable study and ingenuity, and it is problems of this kind that demand the skill of the designer. An idea may look all right on paper, and yet when the machine is built certain parts of the mechanism may not function properly. Many times it is found advisable to build a wooden or sheet-metal model of a certain part of the mechanism in order to make sure that the principle is correct. Models of this kind are easily made and comparatively inexpensive. After testing in this way, the designer can feel sure that the principle on which he is working is correct, and he can go ahead with the design of the mechanism.

How Much will the Machine Cost?

"How much will it cost?" is usually the first question asked by a manufacturer when he thinks of installing automatic machinery. Assuming that a standard product is being manufactured, an analysis of his production problem must be made to determine whether or not it will be economical to use automatic machinery in place of hand labor. This problem should be solved by first finding out definitely what the labor cost is on the product when made by hand; next by determining a period of time for which the product will be manufactured without change; and finally by comparing the cost of production over a certain period of time by hand and by automatic machinery.

Now let a graphic example be taken, in order to make the matter clearer. Assume that a manufacturer of a certain tablet is at present employing girls to count out thirty tablets, put these into a standard bottle, cork and seal the bottle, and paste a label on it. The present production is from 50,000 to 60,000 bottles per week, employing six girls to do the work, in addition to several labor-saving devices of the manufacturer's own invention. These girls receive an average wage of $18 per week. In other words, the labor cost for filling, sealing and labeling 50,000 bottles is $108. This is approximately five bottles for one cent. The yearly labor cost for a production of 2,600,000 bottles is therefore practically $5600. Assuming then that the product will remain standard for ten years or more the labor cost for this period of time would be over $50,000. In addition to this, it must be assumed that the production will be materially increased as the years go by if the product is one that is continually in demand. Suppose the production is doubled and that at the same time labor is harder to get as well as more expensive. To see that this is possible it is only necessary to look back a few years and note the wages paid for labor at that time, as compared with the wages being paid today. However, assuming that production and labor costs remain the same, there would be a labor cost of $100,000 distributed over a period of ten years if the production were doubled. At the end of ten years, it will still be necessary to continue paying for labor.

Now, here is a basis of costs on which to form an estimate as to how much can be economically paid out for an automatic machine. Let it be supposed that it is possible to design and build an automatic machine at a cost of about $10,000, which will count the tablets, put them in the bottles, cork and seal the bottles and paste a label on the outside. Let it also be supposed that this machine will turn out about thirty bottles per minute, 1800 per hour, 14,400 per day of 8 hours, and that it requires the attention of only one girl operator. Thus let the production be set at 80,000 per week, which is well within the possibilities of an automatic machine.

The saving in labor cost for one year would be the wages of five girls at $18 each per week, a total of $90 weekly or $4680 for the year. Two years then would practically pay for the machine, and after that the savings over the hand method would be tremendous. It can be easily seen from the foregoing that it would be profitable to use an automatic machine for the operations mentioned, provided the cost did not exceed $15,000 to $20,000. It will also be seen that the production is over 50 per cent greater than that obtained by the hand method, so that this also must be taken into consideration, when figuring the saving involved.

In general, it may be stated that it is a paying proposition to install automatic machinery to replace hand work,

provided the machine will pay for itself in the first three years. Of course there are many instances in which an automatic machine will pay for itself in one or two years, but speaking generally, and considering the matter from all angles, this statement seems to be borne out by facts.

It will be understood that we have been discussing special automatic machinery designed and developed to suit a particular condition. As is well known, there are various standard automatic machines on the market for making such articles as cigarette boxes, paper cartons, and also machines for wrapping, packing, and labeling certain products. These machines are adjustable within their capacities. It goes without saying that machines of standard types can be bought much cheaper than those developed to suit special conditions.

What Production will it Give?

Mention has already been made of the matter of production, but the factors which influence it have not been considered. If it is assumed that a machine is to be designed in which several operations are taken care of, it is evident that if these are performed in sequence, all the operations must be arranged so that they take the same amount of time. If one operation consumes twice as much time as the other, provision must be made accordingly. Idle time in the machine must be eliminated as far as possible, and when one operation requires twice as much time as the others, the longest time is the controlling factor. It is possible in cases of this kind to provide two units for the operation requiring the longest time, so that these units can maintain a rate of production equivalent to those employed for the other operations. This may not always be necessary, for if the production of the machine is sufficiently rapid, when considering only the operation requiring the longest time, the other operations may, of course, be timed to correspond.

There is also the matter of keeping the production rate of the machine up to normal by making sure that the speed at which it is running is neither too fast nor too slow. If it is to be driven from a lineshaft, care must be taken to make sure that the speeds are what they should be and that they do not vary greatly on account of overloading the power take-off from the shaft. Speaking generally, it is better to provide an individual electric motor, as this is constant and not influenced by the starting and stopping of other machines.

Attention Required by Automatic Machine

Let it be assumed first that the machine has been built and installed ready for work. On a short test it has operated satisfactorily, but will it continue to function properly day after day throughout the year? In the first place a great deal depends on the care that is taken to see that every part of the machine functions properly at the start. The manufacturer who expects to install automatic machinery, should be prepared to give it a thorough trial, and continue to watch over it, making adjustments that are necessary from time to time, until every part has been adjusted and tested thoroughly. Not until this has been done should an attempt be made to put the machine into the regular process of production.

The man who expects an automatic machine to work perfectly from the beginning is likely to be disappointed and had better not make the attempt. The writer knows of an automatic machine costing $12,000 that is not in use because the tolerances of the product which is being handled are so great that the machine will not always function properly. Yet when the machine was designed the allowance for variation in the product was sufficient to satisfy the manufacturer. The machine works perfectly and saves the labor of eight girls, yet it is condemned because it will not do something it was not designed to do. If attention were given to keeping the product within proper limits, the machine would work perfectly and would save nearly $5000 yearly.

It should not be expected that an automatic machine will handle a product properly if the product is not kept within reasonable limits. In regular production work the inspector sets aside the work which is outside the permissible tolerances, and an automatic machine should not be expected to accept and handle a product that the inspector will not pass. In regard to the general upkeep of automatic machinery, if it is properly designed it should not require anything more than an occasional adjustment. Much more care must be given to it, however, than is given to a hand-operated machine, because it must be remembered that it is working continuously, while the hand-operated machine is frequently stopped.

In summing up, the two following important factors influence a manufacturer's decision as to whether or not he is justified in purchasing automatic machinery:

1. A report from a competent automatic machine designer as to whether a machine can be designed which will give satisfactory results.

2. An estimate of the cost of the machine showing that it will pay for itself in the saving of labor in the course of two years, or in three years, at the outside, if the product is standard and not likely to be changed.

These are the only two points that need to be considered, and every manufacturer can use them as a basis to determine his need of automatic machinery.

* * *

WROUGHT-IRON AND STEEL PIPE

The following information relating to the use of the term "wrought pipe" was given in a recent number of *Mechanical Engineering*, the A. S. M. E. Journal: Whether the pipe-maker takes a length of steel skelp or a length of wrought-iron skelp and forms it into pipe, he performs exactly the same operation in either case, that is, he bends the skelp into tubular shape and welds the edges. Quite correctly, therefore, the American Society for Testing Materials in its specifications uses the word "welded" in reference to both wrought-iron and steel pipe made by the welding process.

Probably some thirty years ago, after the introduction of welded steel pipe, the term "wrought pipe" or "wrought steel pipe" was coined by steel-pipe manufacturers. This term gradually came into use by dealers and jobbers; thus steel pipe would be billed and listed as "wrought pipe." Many purchasers of pipe, not being acquainted with this trade name, frequently labor under the impression that it means wrought-*iron* pipe.

The manufacturers of wrought-iron pipe, actively aided by the American Institute of Architects, have therefore taken up with the supply associations the matter of clarifying these so-called trade names, suggesting instead names that would ultimately result in eliminating all confusion of pipe made from puddled wrought iron with that made from soft steel. As a result the National Pipe and Supplies Association at a recent meeting voted that the terms employed by the American Society for Testing Materials in differentiating between iron and steel pipe, namely, (1) welded wrought-iron pipe, and (2) welded steel pipe, should be accepted and adhered to by the distributors of both iron and steel pipe.

This step should result in the term "welded pipe" being applied when *both* wrought-iron and steel pipe are referred to, and in the latter two terms alone, namely, "wrought-iron pipe" on the one hand and "steel pipe" on the other hand, being used and interpreted, respectively, to mean exactly what these terms imply. Thus "wrought-iron pipe" will mean only pipe which is made from genuine puddled wrought iron, and "steel pipe" will be used exclusively to designate pipe made of soft bessemer or open-hearth steel.

Machining Nash Flywheels

Use of Vertical Automatic Lathes for Finishing All Surfaces at Two Settings of the Work

By EDWARD K. HAMMOND

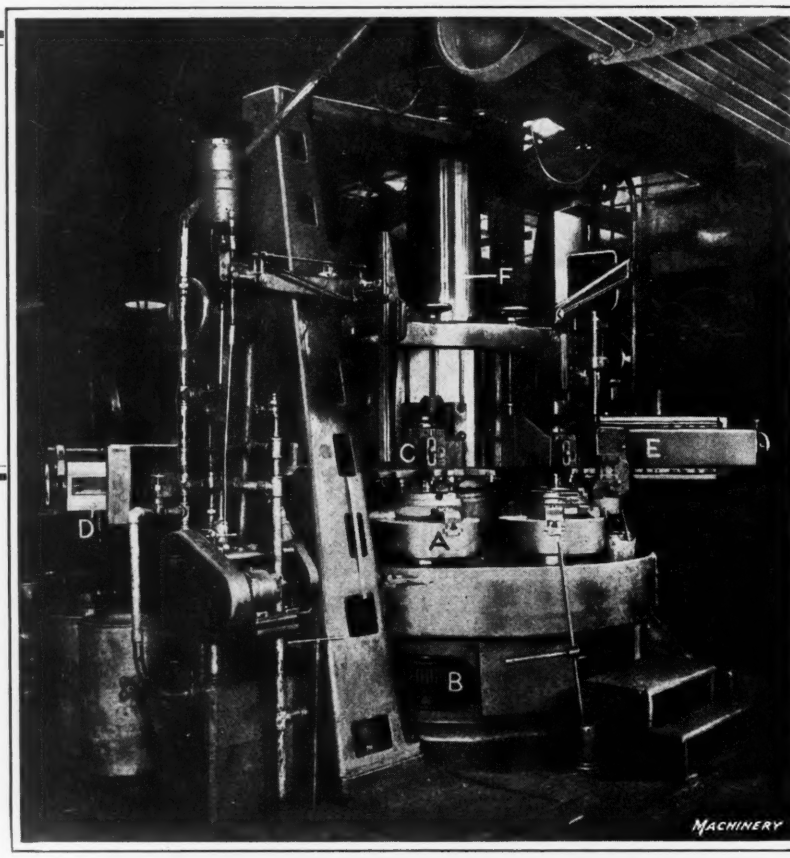


Fig. 1. Ryerson-Conradson Vertical Automatic Lathe equipped for performing Machining Operations on Nash Flywheels

FLYWHEELS for the engines of motor cars built by the Nash Motors Co., at Kenosha, Wis., are required to be machined on all surfaces, and for performing the necessary operations on these parts, this company's maximum schedule of production is easily fulfilled by two Ryerson-Conradson vertical automatic lathes built by the Conradson Machine Tool Co., of Green Bay, Wis., for Joseph T. Ryerson & Son, Chicago, Ill., who control their distribution. Machines of this type have been in almost continuous operation in the Nash plant for the past five years, so that there has been an ample opportunity to demonstrate their productive efficiency. Two settings of the work are necessary, and one of these machines is utilized for the performance of a sequence of operations on each side of the flywheel castings. Probably there are few readers of MACHINERY who are familiar with the features of the Conradson automatic, as only ten of these machines have been built up to the present time. Fig. 1 shows a front view of the machine performing the first series of operations on Nash flywheels. Before describing in detail how the work is done on these parts, a brief description of the machine will be given.

Design of the Conradson Vertical Automatic Lathe

Various methods may be employed for holding the work on one of these machines, but for the first operation on Nash flywheels it will be seen that three-jawed chucks *A* are employed. As shown in Fig. 1 these chucks are connected with the mechanism partially shown at *B*, which provides for rotating each piece of work about the axis of its chuck, while it is in contact with tools that are mounted on one of the five faces of a vertical turret, such a set of tools being shown at *C*. Fig. 2 illustrates in diagrammatical form the arrangement of the work-holding stations on the machine and of the tools above these stations. It will be seen that there are six stations, and while five pieces of work are being simultaneously machined the attendant removes the sixth piece that has been completed and sets up a fresh casting in its place.

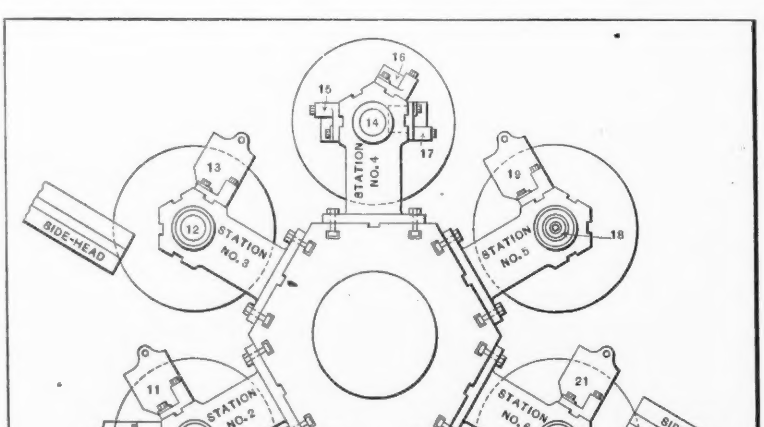


Fig. 2. Diagram illustrating Arrangement of Operating Stations and Tools for performing Successive Operations at these Stations

Most mechanics are familiar with the operation of machines which work on the so-called "progressive-station" principle. The present machine is a case in point, and each time the table is indexed, one finished piece of work is obtained, while the casting at each of the other stations is advanced one step further toward completion. In addition to the five sets of tools carried by the vertical turret of the machine, there are two slides *D* and *E*, Fig. 1, mounted on the housings of the machine, so that side tool-heads carried by these slides can be used for certain operations that can be more conveniently done by such means than with tools supported on the vertical turret of the machine.

How the Machine Operates

To provide for indexing the work from station to station, the turret on which the tools are mounted is connected with a hydraulic plunger *F* and when the turret tools have completed their various operations on pieces of work located at the five stations of the machine, a valve is automatically tripped to enable plunger *F* to withdraw the turret and

thus lift all of the tools clear of the work. After this result has been accomplished, another trip mechanism is automatically engaged to provide for indexing the table on which the six chucks are carried, so that each piece of work may be advanced to the next position in the cycle of movements that it follows in passing under the cutting tools. In this manner, the casting on which the final operations have just been performed will come out from under the last set of tools at the right-hand side of the machine, Fig. 1, so that the operator may proceed to remove the finished piece and substitute a fresh casting. It will be apparent from the preceding description that the operation of this machine is entirely automatic, with the exception of loading and unloading the work-holding fixtures, and as a result, both the machine and its operator are kept constantly employed, so that non-productive time is reduced to a minimum.

Order of Performing the First Sequence of Operations

Fig. 3. Front View of Ryerson-Conradson Vertical Automatic Lathe equipped for performing First Sequence of Machining Operations on Nash Flywheels

Fig. 4 illustrates the Nash flywheel to be machined, in place in a three-jawed chuck which is provided with false jaws that raise the work sufficiently from the face of the chuck so that clearance is provided to allow the outside diameter of the gear ring to be turned at this setting. Figs. 3 and 5 illustrate close-up views of the front and rear of the same machine that is shown in Fig. 1, in order that a better idea may be obtained of the arrangement of the work and tools; and Figs. 6 to 9, inclusive illustrate in detail the tools that are furnished at each station of the machine, and the exact character of the work done by each tool. In addition to the factor of reducing non-productive time of both men and machinery, one of the important reasons why the Conradson automatic is able to obtain such a satisfactory rate of production is that ample power and strength are provided to enable a large number of cutting tools to be used simultaneously. The work done at each station is as follows:

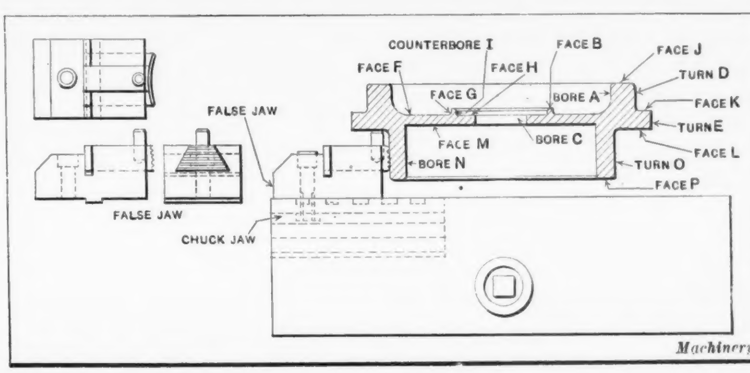


Fig. 4. Method of holding Flywheel for First Sequence of Operations

Station No. 1: Load casting in chuck.

Station No. 2, Fig. 6: There are seven tools at this station which work simultaneously to perform the following operations: Three tools at 7 and 8 rough-bore diameter *A*, rough-face at *B*, and rough-bore hole *C*. Two tools carried by offset brackets 9 and 10 provide for rough-turning diameters *D* and *E*, and the two remaining tools at 10 and 11 provide for breaking the scale on face *F* and forming the fillet *G*.

Station No. 3, Fig. 7: At this station, there are sixteen cutting tools working simultaneously. On the central tool-holder 12 ten tools are mounted to provide for the performance of facing operations on surfaces *B*, *F*, and *H*; and the eleventh and twelfth tools on this holder rough-counterbore *I* and assist in facing surface *F*, respectively. The thirteenth tool is carried by an offset bracket 13 and it takes a second cut on diameter *D*, while the remaining three tools, which are carried by the side-head, provide for the performance of rough-facing operations on surfaces *J*, *K*, and *L*.

Station No. 4, Fig. 8: Five tools are used at this station, and the operations performed by them are as follows: At 14 there are two tools that take a second cut in hole *C*, face surface *H*, form a bevel on counterbore *I*, and take a second cut in the counterbore. The tool at 15 takes a facing cut on face *J*. At 16 there is a formed tool that finishes

Fig. 5. Rear View of Machine shown in Fig. 3

surfaces D and K and forms the fillets. The formed tool carried by holder 17 finishes surfaces A, F, and B, and forms the fillets.

Station No. 5, Fig. 9: Two tools are utilized at this station. At 18 there is a solid reamer for finishing hole C, while the tool carried by an offset bracket 19, takes a second cut on diameter E.

Station No. 6, Fig. 9: Four tools are utilized at station No. 6. A piloted reamer at 20 finishes counterbore I; two offset tools at 21 and 22 take third and fourth finishing cuts on diameter E; and a tool carried by the side-head finish-faces surface L. For the complete sequence of operations performed at the first setting of the work, the various steps of which are outlined in the foregoing paragraphs, the rate of output is 160 flywheels in a ten-hour day.

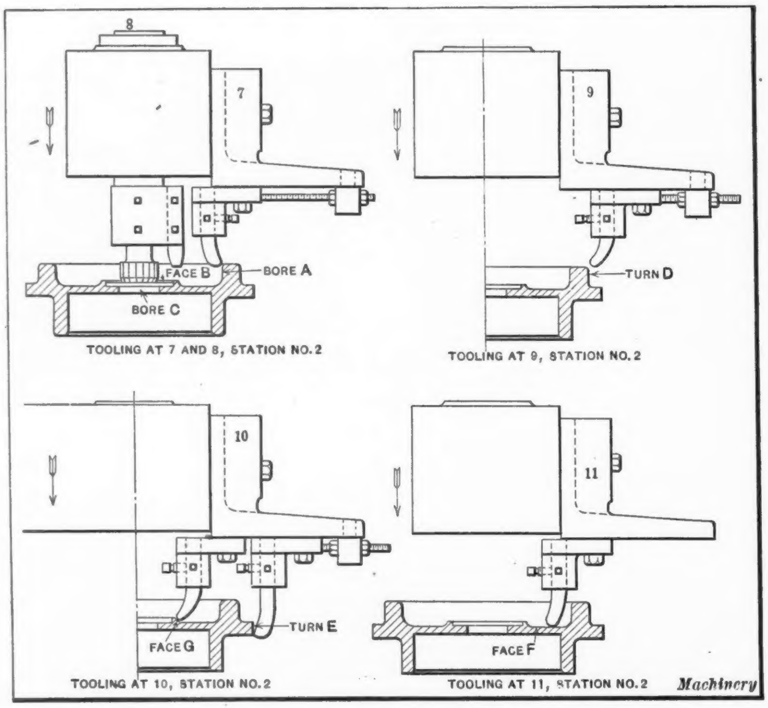


Fig. 6. Arrangement of Tools at Station No. 2, where Seven Tools work simultaneously on Turning, Boring, Facing, and Filleting Operations

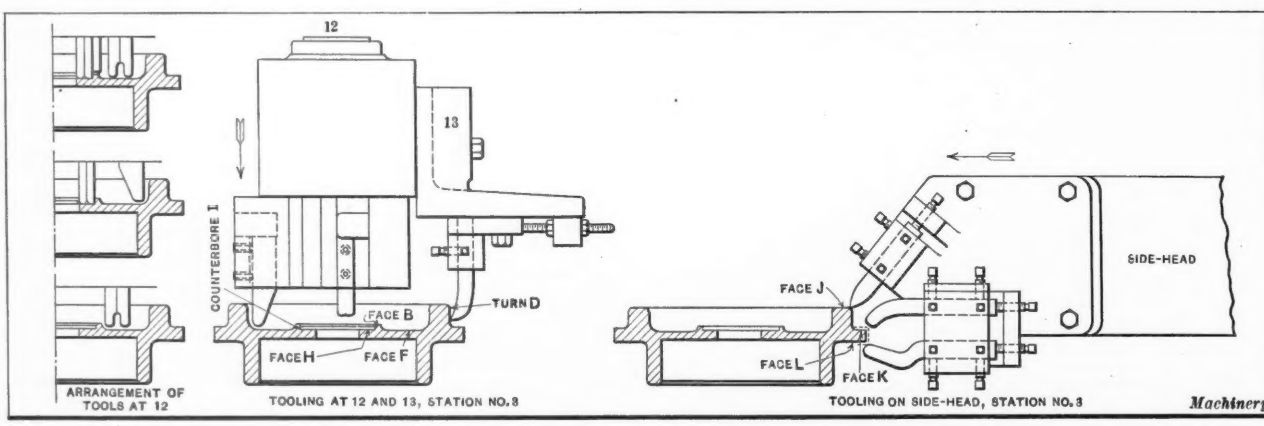


Fig. 7. Arrangement of Tools at Station No. 3, where Sixteen Tools work simultaneously on Turning, Boring, Facing and Counterboring Operations

Design of Tool Brackets and Tool-holders

Fig. 10 shows in details the design of typical forms of tool brackets and tool-holders for use on the Conradson vertical automatic lathe, and by studying these illustrations in connection with the diagrams of the arrangement of tooling and operations performed at successive stations on the machine, the reader will readily understand the methods that are employed for simultaneously operating a number of tools on the same piece of work. Tool bracket A is arranged to bolt directly to a face of the main turret, this being the form of bracket that is shown at C in Fig. 1. At its outer end, this bracket is furnished with four finished faces that are grooved to receive locating tongues on tool-holders of the general form shown at B, which are arranged with slots and clamping bolts to provide for securing the cutter bits in position. In addition to the use of such tool-holders, it will be seen that bracket A is furnished with a central socket which may be utilized to receive the shank of a tool such as a reamer or drill, several examples of this

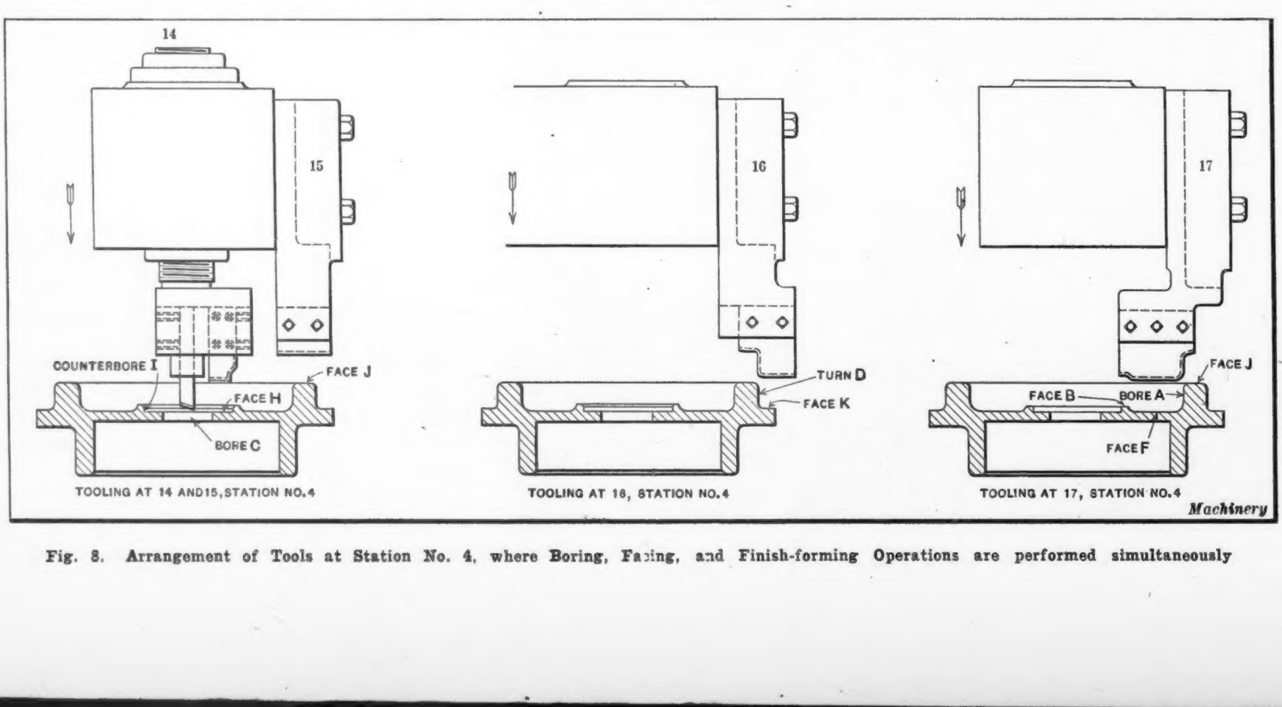


Fig. 8. Arrangement of Tools at Station No. 4, where Boring, Facing, and Finish-forming Operations are performed simultaneously

method of tooling being illustrated.

Another form of tool bracket is shown at *C* in Fig. 10, this bracket being furnished with a tongue to fit into one of the grooves on bracket *A*. The use of an auxiliary bracket of this kind provides for obtaining the required offset for tools that are to work on the outside diameter of the work at points located at some considerable distance from the center of rotation. Other forms of tool-holders are shown at *D* and *E*. At *F* there is shown the design of the side-head tool bracket and tool-holder that are used at station No. 6 of the machine shown in Figs. 1, 3, and 5; and at *G* there is illustrated the side-head tool-holder that is employed at station No. 3 of the same machine.

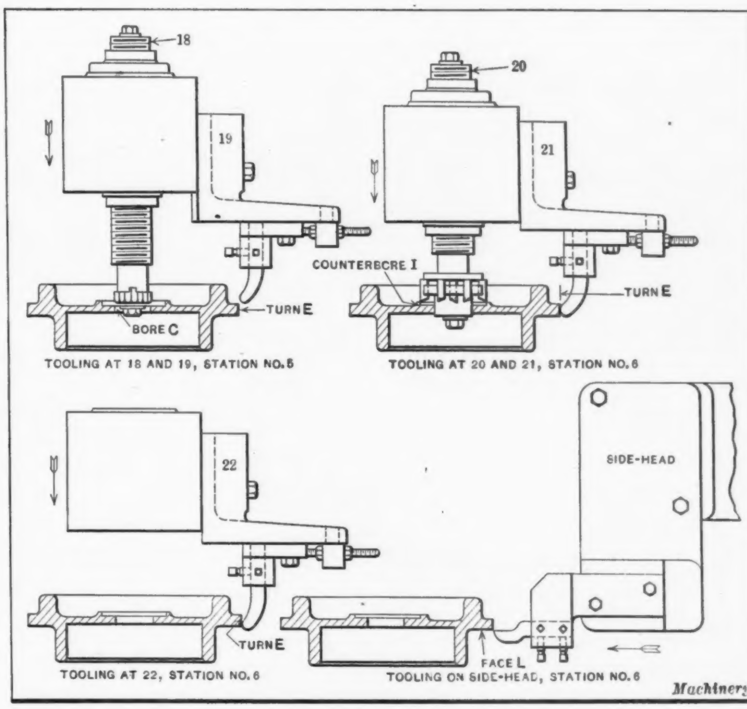


Fig. 9. Arrangement of Tools at Stations Nos. 5 and 6, where Finish-turning, Facing, Boring, and Counterboring Operations are simultaneously performed

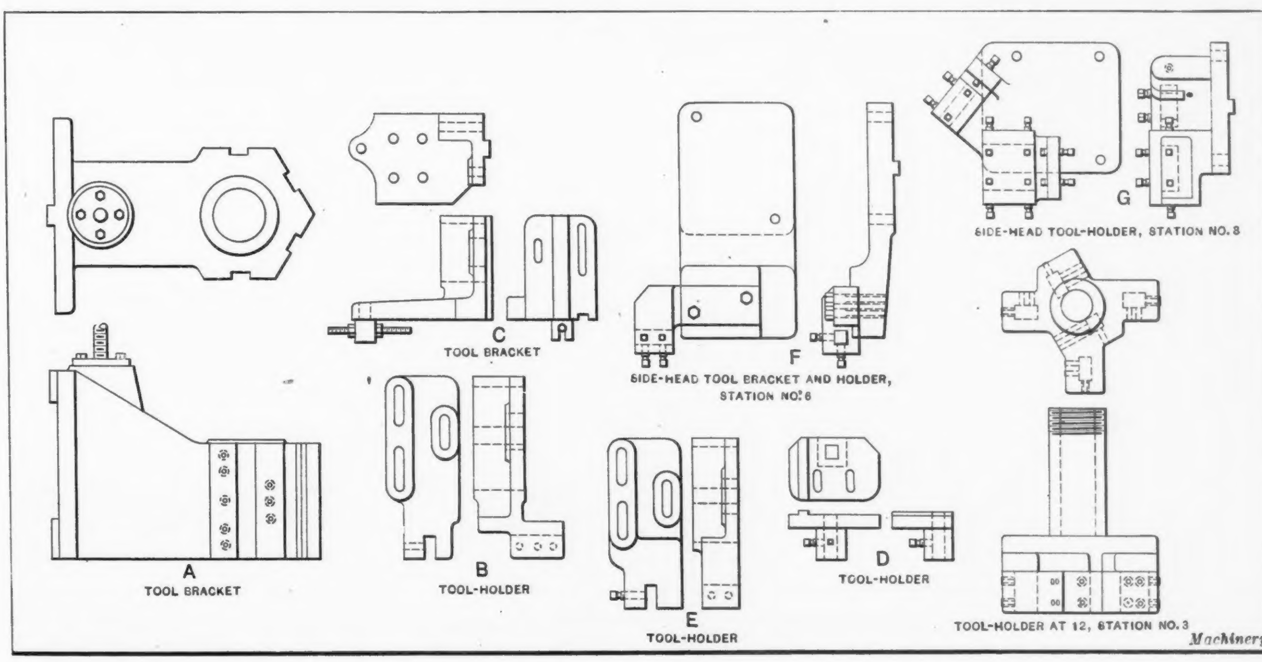


Fig. 10. Design of Tool Brackets and Tool-holders used on the Main Turret and on the Side-heads of the Machine employed for the First Sequence of Operations

Design of Tools and Planning of Successive Operations

After following through the preceding description of the successive operations that are performed to finish the entire upper side of a Nash flywheel, the reader will have already gained a comprehensive idea of how the cutting tools are designed and how the successive operations on work of this kind are planned. However, there are certain points which it may be well to emphasize, as they have an important bearing upon the amount of service which can be obtained from the tools and the rate of output that is secured. It will be seen that considerable use is made of standard forms of forged tools, because they are inexpensive to make and quite simple to grind. For such operations as rough-facing surface *F* and forming the fillet *G*, Fig. 6, it will be seen that a number of these simple forged tools are employed for removing the bulk of the metal. This service is severe and requires the tools to be ground quite frequently, but, as previously stated, the grinding is a simple operation which can be handled without great expense.

After the surplus stock has been hogged out, the final finishing cut is often taken with a formed tool, as shown in Fig. 8, which illustrates the tooling at station No. 4. This tool provides for finishing faces *A*, *F*, and *B* and for forming a radius at the junction points between each of these surfaces. Similarly, it will be seen that formed tools of this kind are utilized for finish-facing surface *H*,

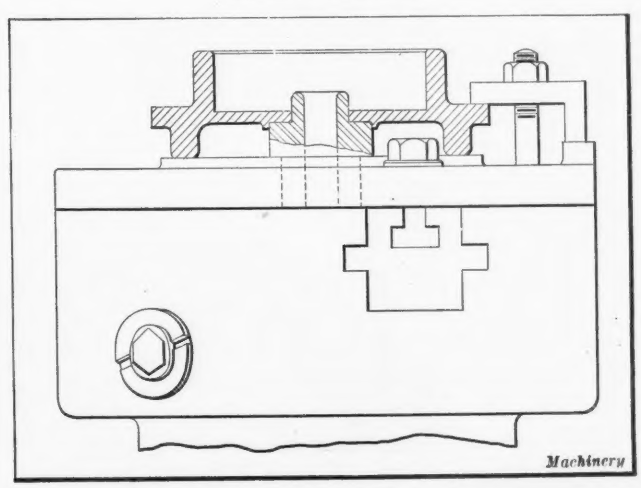


Fig. 11. Method of holding Flywheel for the Second Sequence of Operations, showing Pilot for locating the Work

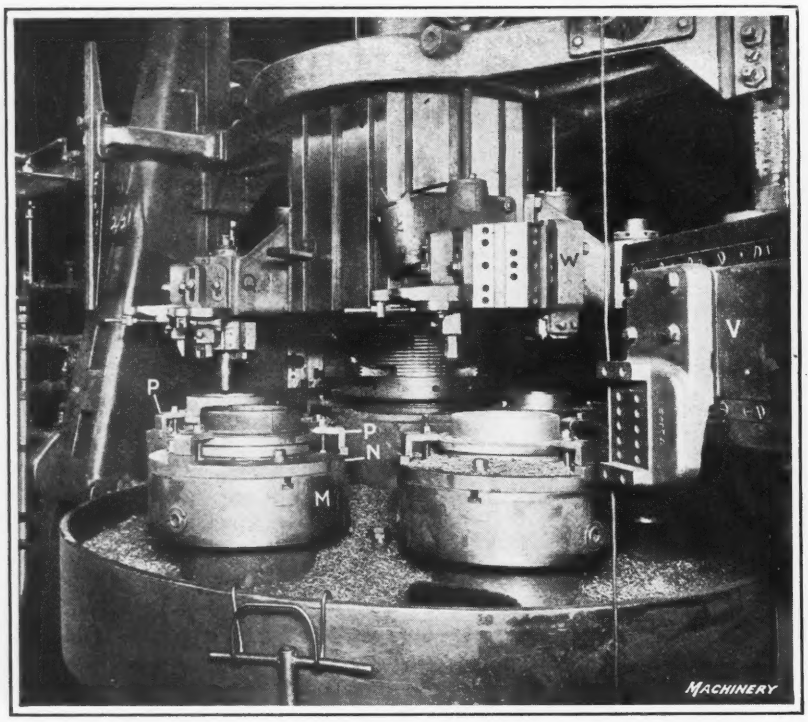


Fig. 12. Front View of Ryerson-Conradson Vertical Automatic Lathe equipped for performing Second Sequence of Machining Operations on Nash Flywheels

counterbore *I*, and the bevel at the top of the counterbore, and for facing surface *J*, diameter *D*, surface *K* and the radius that is required at the junction of each of these surfaces. Finish-forming tools of this kind enable a very satisfactory finish to be obtained, and as the greater part of the stock has already been removed by roughing tools, the expensive formed tools are not rapidly worn out.

Operations Performed on the Second Machine after the Work has been Reset

In resetting the Nash flywheel castings for performing a second sequence of machining operations that are required on the opposite side, advantage is taken of the fact that diameters *C* and *I* have been previously bored. These two openings in the work are dropped over a double pilot supported by a fixture of the kind that is carried on each of the rotating faceplates that are mounted on the main table of the machine. Reference to Figs. 11 and 12 will make it apparent that secured to the top of each chuck *M* there is a plate *N*, at the center of which there is mounted the double pilot previously mentioned. Plate *N* is held in place by bolts that enter T-slots in the faceplate; and the work is held down on the fixture by means of straps *P*. As on the previous machine, this Conradson vertical automatic lathe is equipped with five operating stations and a sixth position at which castings are loaded into the fixtures and removed after completing the required sequence of machining operations. For the performance of this sequence of operations, the general arrangement of cutting tools is similar to that for the first setting, and so a detailed description is unnecessary. The work done on this machine is as follows:

Station No. 1: Load casting into fixture.

Station No. 2: Nine tools are carried by the turret-head *Q* which operates on the castings at the second station; and the operations performed by these tools are as follows: Five tools operate simultaneously to provide for rough-facing surface *M*, Fig. 4, and two tools rough-face the inner portion of surface *L* which was not reached by the straddle-facing tools on the side-head *D* of the machine shown in Fig. 5, that simultaneously faced surface *K* and the outer portion of surface *L*. In addition to the facing tools employed at the second station of the machine shown in Fig. 12, there are two vertical tools that provide for simultaneously rough-boring diameter *N* and rough-turning diameter *O*, Fig. 4.

Station No. 3: At the third station there are eight tools engaged in performing machining operations on the work. They are carried by both the vertical turret-head *R*, Fig. 13, and the side-head at the rear of the housing. The arrangement of tools is very similar to that described for the second station. Five tools provide for taking an intermediate facing cut on surface *M*, Fig. 4, two tools rough-bore diameter *N* and rough-turn diameter *O*, respectively, and one tool takes a rough-facing cut over surface *P*.

Station No. 4: On the face of the turret above the fourth station at which the work stops for machining there is a head *T*, Fig. 13, which carries a broad-faced tool that provides for taking a finish-facing cut over surface *M;* also, there are two straddle tools which finish-bore diameter *N* and finish-turn diameter *O;* and while this work is being done, a fourth tool carried by the same head is engaged in taking a facing cut over surface *P* on the work.

Station No. 5: Above the fifth station, the turret-head *U* carries a single inserted-blade reamer that provides for reaming diameter *N* to the required size. It will be seen that this reamer is furnished with a pilot that enters a hardened bushing in the fixture to assure attaining the required degree of accuracy.

Station No. 6: It will be evident from Fig. 12 that there is a side-head *V* at the front of the right-hand housing on the machine, but no tools are mounted on this head for use in performing the second sequence of operations on Nash flywheels. The final work to be done on these castings is of quite a simple nature, consisting of finish-facing surface *L* and using a pair of straddle tools on surfaces *N* and *O* to provide for forming the upper portions of these

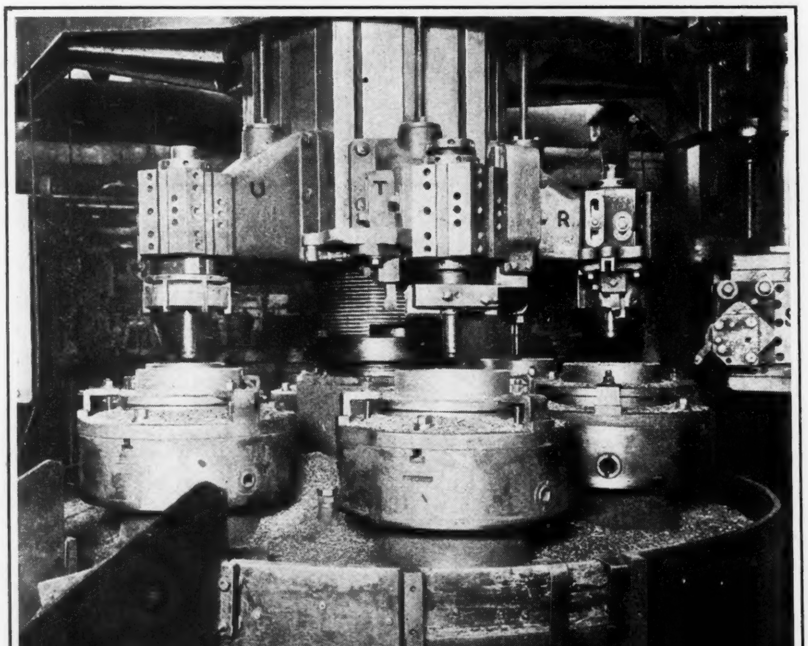


Fig. 13. Rear View of Machine shown in Fig. 12 equipped for performing Second Sequence of Machining Operations

surfaces to conform with the required radii of curvature. In performing this complete second sequence of operations, the rate of production is 130 flywheels per ten-hour day.

Classes of Work for which the Conradson Vertical Automatic Lathe is Adapted

Since the work of the sales engineer has become more fully understood, there has been a steadily increasing tendency toward the purchase of equipment for industrial plants on a basis of the actual expense of obtaining the required service, rather than upon the first cost of the equipment. It has been conclusively shown that this is the only true method of attaining maximum economy in performing machining operations, and the judicious purchasing agent is likely to regard the item of first cost as a secondary consideration. Take the case of the Conradson vertical automatic lathe. It is a machine of high productive capacity, but owing to the size and complexity of its parts the cost of construction is necessarily quite high. A machine of this kind will prove a profitable investment to a firm that has a sufficient volume of work on which the lathes can be run to keep them constantly employed during the full working day. But the size of the expenditure which is represented by the purchase of such a machine shop equipment is such that an experienced purchasing agent would not consider buying machines of this type unless there were a sufficient quantity of parts to be handled so that the machines could earn a satisfactory return on the investment.

* * *

GRAPHIC METHOD OF CALCULATING IRREGULAR VOLUMES

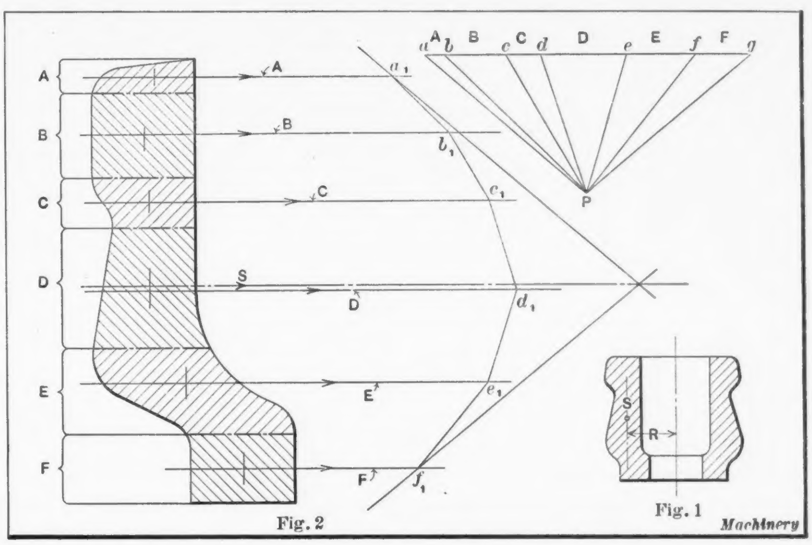
By R. KRAUS

Occasionally a question arises during the proposed design of a section where the basis of weight has to be considered. It is then necessary to figure the volume of the body. If the body is produced by the rotation of an irregular section around an axis, then the center of gravity, or at least the distance from the rotating axis, has to be found. In Fig. 1 the section of a round body is shown, the volume of which is to be determined.

The general formula for the volume is as follows: Volume $= A\,2\pi R$ in which $A =$ area of the section and $R =$ the distance from the rotating axis to the center of gravity of the area (see Fig. 1). In order to find the center of gravity the general practice is to cut the section desired from cardboard and suspend it from two different points; then plumb down, the intersection of the plumb lines being the center of gravity. For small and very irregular shapes this method is impracticable. Another method used is the mathematical procedure of calculating the sum of the moments of all the areas about two different axes.

A more satisfactory procedure is to find the center of gravity graphically by application of the polygon of forces. Divide the given section into a number of subdivisions A, B, C, etc. (see Fig. 2); find their respective areas, and consider these areas as forces acting through their respective centers of gravity. Let these forces also be called A, B, C, etc. The resultant of these forces will pass through the common center of gravity and is found by the use of the polygon of forces. To proceed, draw a line parallel to the direction of the forces A, B, C, etc., and show thereon, to some convenient scale, the forces A, B, C, etc. (this scale need not be the same as used for the section). Let the force A be represented by the length ab, the force B by the adjacent length bc, etc. Then choose a point P and connect the points a, b, c, etc., with this point. Now choose a point a_1 on the force line A, and draw a line parallel to aP, intersecting a_1 and of indefinite length.

Then continue with a line parallel to bP from a_1 until this line intersects the force line B, and so on until the final intersection at f_1. Now draw a line parallel to gP through f_1 and continue until it intersects the line parallel to aP. Through this intersection draw a line S parallel to the forces A, B, C, etc. This line will then pass through the common center of gravity. To find the location of the center of gravity, proceed as before using the same method and assuming that the forces are acting in a different direction, for instance at 90 degrees. Proceed the same as before, and the center of gravity will be where the new resultant intersects the resultant previously found.



Figs. 1 and 2. Irregular Section, and Graphic Method of locating Center of Gravity

In the illustration shown, only the distance R of the center of gravity from the rotating axis is required. For this solution only one polygon is necessary, namely, with the forces acting parallel to the rotating axis (Fig. 1). To give a clearer understanding of the method, the direction of the forces has been indicated in the diagram Fig. 2.

* * *

A NEW METRIC BILL IN CONGRESS

A new metric bill (H. R.-10) has been introduced in the House of Representatives by Mr. Britten, the bill being entitled "To fix the metric system of weights and measures as the single standard of weights and measures for certain uses." Under the provisions of this bill it would be unlawful after ten years for anyone to sell any goods, wares, or merchandise, or to charge or to collect for carriage or transportation of any goods, wares, or merchandise in accordance with any other system than the metric system of weights and measures. While the avowed purpose of the bill is to make its provisions applicable only to trade and not to manufacture, the Publicity Service of the American Institute of Weights and Measures, 115 Broadway, New York City, calls attention to the fact that it is clearly drawn with the idea of making it an entering wedge for further legislation. The manufacturers of the country objecting to the metric legislation promptly organized against the recent metric propaganda, and have presented such a strong opposition that they have been exempted from the operation of the law. Whatever might be said in favor of the metric system for laboratory and scientific work and for purposes of computation, no possible benefit can be conceived of which would accrue to the retail trade of the country by the use of the metric system as against our established units.

Industrial Conditions in Germany

From MACHINERY'S Special Correspondent

Berlin, May 6

OWING to the uncertainty of the present international situation there is a disinclination to business of any kind, domestic as well as foreign buyers hesitating to place orders. A definite turn for the worse occurred during the month of February. The possibility of an imposition by the Allies of a duty on all exports has been especially responsible for the loss of foreign trade. In the machine tool and small tool fields, the manufacturers of automatic screw machines, taps, and milling cutters have sufficient orders to keep them busy for months to come, but the remaining machine tool builders are working on stock. Manufacturers of drills have been compelled to leave all foreign business to competitors.

Many machine tool builders have returned to the piecework basis of payment, and in the report of Messrs. Pittler, who recently declared a 15 per cent dividend, great advantages are claimed for this system. The Magdeburger Werkzeugmaschinenfabrik Joint Stock Co. has also paid a dividend of 15 per cent. This concern has become affiliated with the Fritz Werner Joint Stock Co., Berlin. The Wotanwerke, Leipzig, have taken over the Saxonian gear factory of the late Max Schütz, Chemnitz.

Out of 5,626,000 workmen in all industries of which official reports were on hand March 1, approximately 266,000 were idle. The number of metal-workers included in this list was 1,332,500, of which 4.1 per cent were unemployed.

The Leipzig Fair

The amount of business transacted at the Leipzig fair held this spring surpassed the expectations of many exhibitors. Many machine tools, sheet-metal and woodworking machines, and small tools were sold. All types of machine tools were well represented, a machine of special interest being a lathe exhibited by Heidenreich & Harbeck, of Hamburg. This machine is designed for turning long shafts of various diameters, and is provided with two carriages on which six tools may be mounted. This arrangement permits the simultaneous turning to a number of diameters. Another machine that attracted considerable attention was a motor-driven open-side planer built by Billeter & Klunz. This machine is equipped with an ingenious head provided with vertical and horizontal feeding movements which may be operated simultaneously but independently of one another. A small internal grinder developed by the Fortuna Werke finishes holes down to 2 millimeters (0.0788 inch) in diameter.

The Locomotive Industry

Builders of locomotives and railroad cars are well supplied with work. According to the Railway Minister, the total orders placed consist of 4526 locomotives, 74,400 freight cars, 6000 passenger cars and 1000 baggage cars. One hundred of the locomotives were ordered by Spain, 40 by Roumania, and 600 by Russia. An indication of the competition offered foreign manufacturers of locomotives may be obtained from the following comparisons of bids made: In bidding on locomotives for Argentine railways, German builders bid 4.11 pesos per kilogram (79 cents per pound, present exchange), while the price asked by English competitors was 4.74 pesos per kilogram (91 cents per pound). In bidding on 10,000 railroad car wheels, also for Argentina, the bid of the Krupp Werke, of Essen, was only 40 per cent of the lowest American bid.

Business Relations with Soviet Russia

Negotiations concerning business relations between Germany and Russia resulted in the signing by both countries, of a protocol controlling this matter. The amount of trading between the two countries is larger than is generally thought. Between May 15 and December 31, 1920, the total exports to Russia of agricultural equipment, machinery, automobile accessories, and electrical equipment amounted to 173,200,000 marks ($2,700,000, present exchange). The trade was actually far greater than this, as many goods were illegally exported across border countries. The export figures will, no doubt, be considerably greater this year, due to the delivery of some of the locomotives mentioned.

In connection with the locomotive orders, it is interesting to note that the committee appointed by the Soviet Government to negotiate for the purchase of railroad equipment is instructed to order 2000 freight locomotives and from 4000 to 5000 passenger locomotives, besides much repair equipment and spare parts. Orders for 1000 locomotives have been placed in Sweden. The German locomotives will be designed by Henschel & Son, Cassel, but they are to be built in nineteen different plants on a strictly interchangeable plan. In order to see that this specification is carried out, a sample locomotive will be assembled from parts selected from each of the nineteen plants. The locomotive spare parts ordered in Germany amount to 48,000,000 Swedish crowns ($11,208,000, present exchange). The German bid on these parts was more than 50 per cent less than that of Swedish concerns. However, the reason German manufacturers received the orders was not so much on account of the cheaper prices but because of the earlier deliveries promised. The first contract was signed in October, 1920, and by January, 1921, 1500 tons of parts had been shipped.

The Automobile Industry

Many of the plants erected during the war for the manufacture of trucks and automobiles are now engaged in making a variety of products such as tractors, bicycles, typewriters, electric motors, pneumatic tools, ball bearings, small arms, etc. According to the census of February, 1919, there were then twenty-three automobile plants employing 33,350 men. In February of this year, the number of employes in the same shops was 26,470. The plants ordinarily operate from forty-four to forty-eight hours per week; but at present, some are only working twenty-four hours per week. All automobile plants pay the employes on the piecework basis. The hourly wages for skilled workmen average from 5.6 to 8.3 marks (from 9 to 13 cents, present exchange).

The Metal Industries of Holland

The metal-working industries of the Netherlands cannot be placed on the same level as in other countries, because there are no blast furnaces or rolling mills. Out of approximately 100,000 workmen engaged in these industries, 40,000 are employed in shipyards, 10,000 in machine shops, 4000 in foundries, and 3000 in automobile and motorcycle factories. In general, the working hours are from forty-five to forty-eight per week. Prior to the war employes worked sixty hours per week. The average weekly wages of skilled metal workers at that time amounted to 18 guilders ($7.23, normal exchange), while now they average 38 guilders ($13.37, present exchange), an increase of 110 per cent in Dutch money.

PROMOTING EFFICIENCY IN RAILWAY SHOPS

By M. C. WHELAN
Foreman, Frisco Railway, Kansas City, Mo.

With their present income barely sufficient to meet operating expenses, the railroads face the necessity of increasing efficiency in every possible way. This requires the cutting of war-time red tape so that employer and employe can deal more directly with each other and in a more personal manner than was possible during the war. Rules and regulations that restrict production must be eliminated.

Shop practice comprises a field of great magnitude and importance, without a comprehensive knowledge and constant study of which a supervisor of mechanics in a railroad shop is incompetent. The following are a few facts observed from time to time which should be given careful consideration by all supervisors. They are records of a few of the many inefficient and costly practices in railroad shops, and are given for the purpose of constructive criticism. From these records supervisors and shop foremen can draw their own conclusions as to whether present mechanical supervision is perfect or otherwise.

Highly Paid Mechanics Performing Helper's Work

Eight piston keys were brought from the roundhouse to the shop to be straightened by a mechanic and his helper, requiring four trips each way for two men, one man being paid eighty-five cents per hour and the other forty-five cents per hour. What mechanical skill was required to perform this work and wherein does proficiency in supervision appear? In another instance, a mechanic and helper walked from the roundhouse to the shop, obtained iron for U-bolts for guides, took the iron to the threading machine, and from there to the blacksmith shop, and gave instructions for forming. In about three-quarters of an hour the mechanic and helper again went from the roundhouse to the shop, obtained the U-bolts, and returning to the roundhouse applied them to the engine. The roundhouse is 350 yards from the shop and the threading machine seventy-five yards from the blacksmith shop. Under such conditions, is it any wonder that the management states that there are too many mechanics for the amount of mechanical work performed?

The proper way to perform the latter job would have been to have the mechanic measure the width and length of the U-bolts required, and then have the supervisor make a pencil sketch of the pieces wanted, after which a wiper or helper could be sent to the supervisor of blacksmiths, who would have the stock cut to length and sent to the threading machine, accompanied by a note giving specifications for the threads required and the engine number on which the parts were to be used. The mechanic could then be employed on some necessary work for which he is paid, and not be doing laborer's work at mechanic's pay.

Another instance noted was that of a skilled mechanic carrying spring hangers, equalizers, and various parts of spring- and brake-rigging, from the shop store-room to the drilling machine, slotter, and lathe. This is another case in which the supervisor failed in his duty while the laborer smiled at the thought that it required a mechanic to perform his task.

Again, a mechanic specializing on link motion, made eight trips between his work-bench and the blacksmith shop in one day. Perhaps he made more than eight trips, but this number was noted. Why was a helper not delegated to take and bring back the parts this man needed, so that at least 60 per cent of his time could be utilized in working at his trade instead of walking around?

Lack of Supervision the Cause of Much Inefficiency

A main air reservoir proving a hindrance to some frame repair work on an engine was required to be removed. The foreman ordered the clamp supports cut out, as the easiest way to disconnect the reservoir drum. An acetylene torch was used, and both top and bottom clamps were cut, although only one—the bottom one—was required to be cut to permit removing the reservoir. One band was left in the pit, and an order from the foreman to the shop read, "Make two as per sample," the sample being one of the bands that had been cut off. The supervisor had not even glanced at the job, and a lead pencil and pad took the place of supervisory energy and foresight. In this instance the orders of the foreman were not carried out, however. The two 6-foot bands of 7/8- by 4-inch iron were repaired and a saving of eleven dollars made in a job that should not have cost even five dollars if properly handled.

In a great many shops the injudicious use of the cutting torch, as in this case, results in adding needless expense items to repair jobs, and is also the cause of a great deal of inferior work. The instance cited above shows the fallacy of a supervisor in one department doing what he is told by the supervisor of another, or blindly following a written order to the letter without any investigation or knowledge of the purpose for which the work is intended. In other words, without cooperation and the exercise of the proper amount of supervision, there must be much inefficiency. To supervise properly, requires more effort than the use of a pencil and a slip of paper, and the supervisor's duty is not done when a task is reported completed unless he, as an expert, knows that the work is done properly.

National Railway Agreement Prevents Efficiency

The actual occurrences noted may appear magnified, but if each supervisor will adopt the rule of using his foreman's eye he will find conditions of a like nature in nearly all shops. The National Railroad Labor Agreement has tied the foreman's hands almost to the extent that he cannot show by actual workmanship how an apprentice shall perform a piece of work. Some foreman with a sense of humor who felt the restricting power of this agreement added another clause to the rule whereby "no foreman shall perform any work, except those stationed where no mechanics are employed" to read, "nor shall they in any way tax their thinking power in formulating plans for obtaining more mechanical and efficient performances or systems." Of course, a supervisor should not be placed at a given task where he cannot put into execution ideas and proper supervision, because his mental qualities should be at all times free to note defects, improvements, and proficient methods, which he may observe through the well-trained and experienced eye of a foreman. But he should be at liberty to turn his hand to a manual task when efficiency and results are promoted thereby.

* * *

ACCIDENT COSTS PART OF PRODUCTION COSTS

In a recent issue of *National Safety News*, attention is called to the fact that accident costs should be considered part of production costs. In many plants, reports are compiled at regular intervals, showing at what cost each department is operated and what the production is for each period. It is assumed by the reader of such reports that the most successful foreman is the one whose department shows the largest production at the lowest relative cost. Accidents lower production and increase cost, and yet many companies do not consider this item when preparing cost and production reports. Surely there is no more logical and better way to bring safety to the attention of the foremen than by adding to their operating cost the cost of all accidents that happen in their departments. There are some companies that appreciate this point and have for some time included the cost of accidents in their cost and production reports.

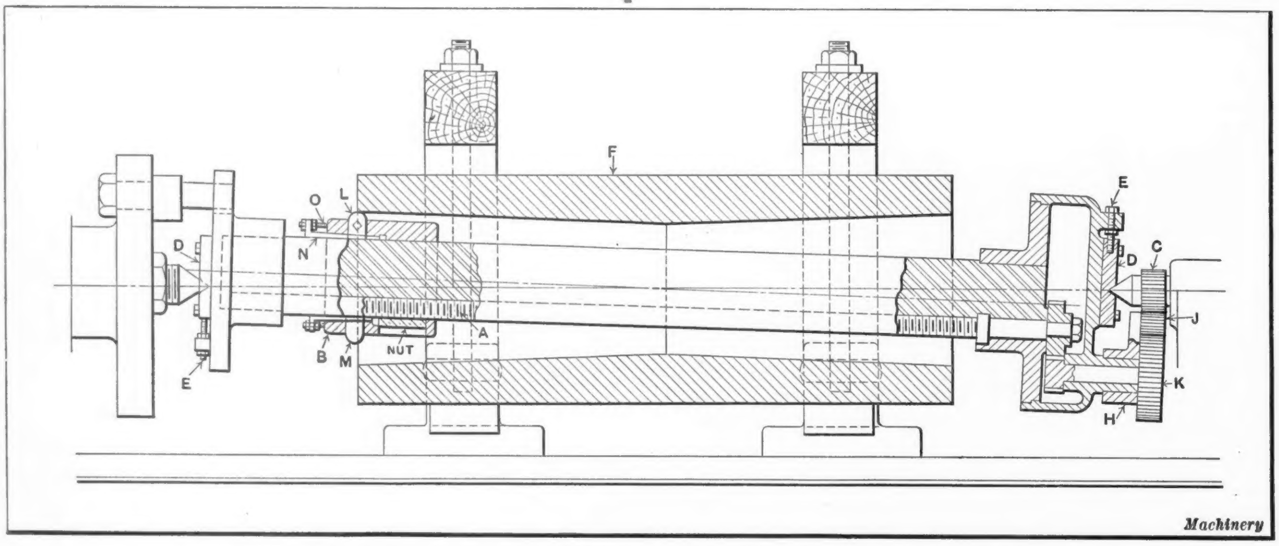


Fig. 1. Taper Boring Device mounted on Lathe in Position for boring Double Taper in Bushing

TAPER BORING DEVICES

By W. C. STEUART

The devices shown in the accompanying illustrations have been in use in the Detrick & Harvey plant of the Bethlehem Steel Co., Baltimore, Md., for many years and have proved invaluable in boring large taper holes in bushings. Each one consists of a traveling-head boring-bar mounted on centers and having a feed-screw *A* located in a groove on one side of the bar. This screw serves to feed the head *B* along the bar, deriving its motion from a train of gears rotated "sun-and-planet" fashion around a pinion *C* cut on the stationary or dead center. The required taper is obtained by offsetting one or both ends of the bar by means of slides *D*, which are adjusted by screws *E*. These slides have center holes in their faces, and are attached to the end or ends of the bar as indicated.

Fig. 1 shows one of the bars mounted on a lathe in position for boring a hole tapering in opposite directions from the middle to both ends of a bushing *F*. Offsetting slides *D* are provided at both ends of the bar. In Fig. 2 is shown a bar mounted on a horizontal boring machine. In this case only one offsetting slide is required, as the work consists of boring a single taper in bushing *G*. When the bar has an offsetting slide at each end, as shown in Fig. 1, it is necessary to provide a pivoted bracket *H* for idler *J* to permit bringing idler *J* and pinion *C* into proper mesh after adjusting slide *D*. It is not necessary to have a pivoted bracket on bars used in boring single tapers, but it is well to provide one as it permits using change-gears to vary the feed.

When double tapers are bored, two tools *L* and *M*, are required, one cutting half the length or one taper, and the other, the remaining distance or the other taper. For single tapers, only one tool *M* is necessary, as shown in Fig. 2. It will be noted that both the feed and rotary motion are confined to the bar itself, which is driven from the spindle of the machine. The work is entirely stationary, and where the device is used in a lathe the work may be held in blocks or in a cradle bolted to the ways. The tools are adjusted by means of a taper bushing or gland *N* located in place by set-screws *O*.

* * *

British trade reports indicate that Sheffield is making great progress in developing the manufacture of circular saws for cutting cold metal, as well as smaller screw-cutting and slitting saws for machine shop use. In the past, the bulk of this business in Great Britain went to the United States. It is stated that the prices at which the Sheffield concerns offer saws and cutters of this kind are much lower than the prices of the American product. Every process from the raw material to the finished product is carried on in the plants of the steel makers, as they are, themselves, taking up this line of manufacture.

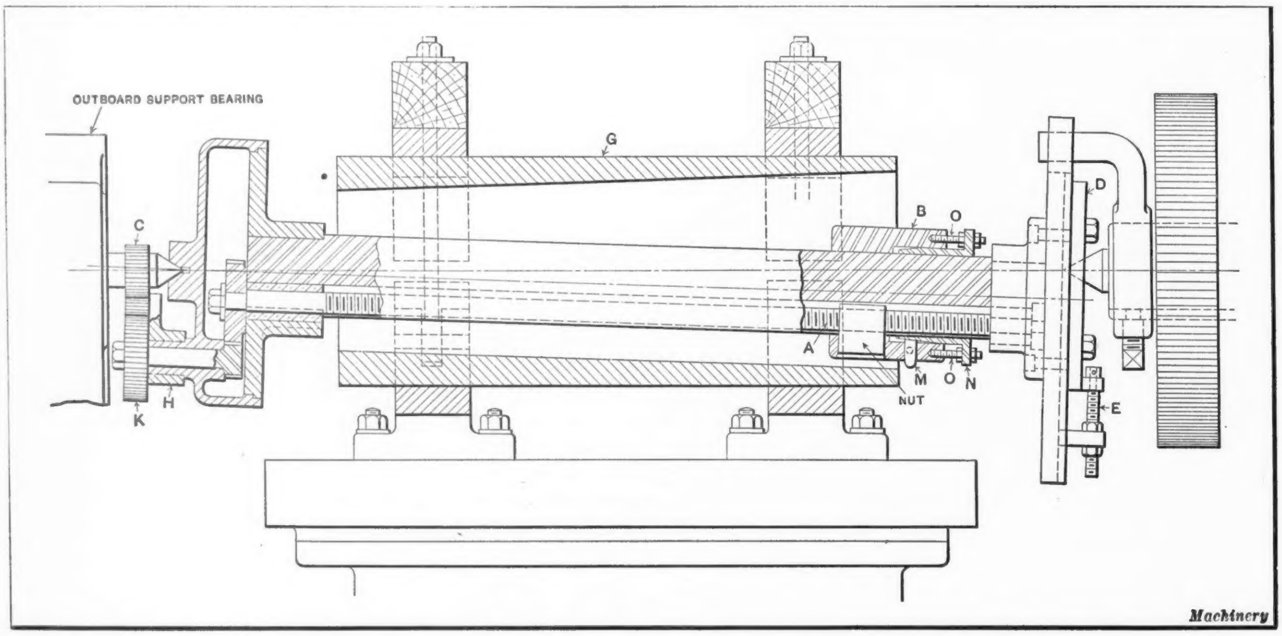


Fig. 2. Taper Boring Device mounted on Horizontal Boring Machine in Position for boring Single Taper

Common Causes of Errors in Machine Design

Accuracy in Drawings—Sixth of a Series of Articles

By R. H. McMINN

DRAWINGS are one of the principal means of conveying the instructions of the engineering department to the departments of the shop, so lack of clarity or errors in drawings result in parts wrongly made. In a well organized engineering department of a company that has been established for some time, old drawings of machines similar to the one being designed can often be used for reference to good advantage in suggesting the arrangement of views on drawings to be made and in showing many points which are the result of much experience in a particular type of machine. A designer should not be too quick to discard an old design or be too critical of some peculiar construction or shape of a part previously used. The very fact that it is peculiar probably explains its merit for the purpose intended. However, care should be taken not to use an old design when it is not adaptable to conditions demanded by the new machine, even though a superficial view may indicate its suitability. One must see that familiarity does not breed contempt and thereby induce a careless analysis of the proper design for machines which are constantly duplicated except for alterations to suit special conditions. The habit of the mind in assuming that parts usually unaltered in such machines will always be unaltered must be watched carefully, in order to prevent the adoption of unsuitable designs.

A draftsman working on part of the details of a machine may not be familiar with its whole design. He must, however, be careful to properly relate the parts he is detailing to the whole machine. The form, size, and location of any parts of a machine are largely determined by the form, size, and location of other parts. The parts, lines, and dimensions on any drawing being used for reference must be thoroughly identified. In copying a dimension from another sheet, the most accurate results are obtained by saying to oneself, "From edge of casting to center line of hole is so-and-so," and not merely glancing at the other drawing. This aids in concentration and helps to retain the proper relationships in the mind until the figure is correctly used.

Checking Calculations

Designers and draftsmen must be careful not to be misled by errors in their calculations of areas, volumes, centers of gravity, strength of parts, etc. Reason and past experience should be used as a check upon the results of any series of calculations, instead of accepting the result blindly. In figuring an area of irregular shape, a rough check may be obtained by noting the area of the nearest inscribed and circumscribed regular figures. One then knows that the result sought at least lies between these values. The same principle may be applied roughly in checking the volume of an irregular shaped receptacle.

It is important to keep in mind during a series of calculations what the result of each step represents, and to label each result in any series. Frequently the mere indicating, in order, of a series of calculations which it is necessary to perform to obtain a certain result, leaving the figuring until later, will be an assistance in obtaining the result sought. It should constantly be considered what error is allowable without preventing good working or unsafe results. Known errors may therefore be admitted, instead of going into unnecessarily elaborate calculations to get exact results. The designer should be able to determine, however, when exactitude is necessary. If it were desired to revolve an irregular shaped body about its center of gravity, the exactness with which the center of gravity must be located depends somewhat on the size and weight and the speed at which the body is to revolve.

Checking from the Drawing Itself

When starting a lay-out, the correctness of location of lines should be checked as the work proceeds. An accurate beginning makes one less liable to make a mistake without detecting it by mere observation. No line should be drawn that can conveniently be drawn later in the design, in order to avoid possible need for erasure. Comparatively insignificant details should not be put in until last. Mere drawing is monotonous, so an attempt should be made to maintain alertness by keeping the mind free to plan correctly. As little drawing should be done as is necessary to give sufficient information to those who will use drawings; but enough should be done to prevent all chances of falling into error. A complete assembly, even down to the most minute details, offers the best obtainable guide for predicting the result of operation of a new machine.

If the true shape of a portion of a detail is considerably distorted in one or more views, due to its being at an angle with the main lines of the detail, additional views of this portion may have to be drawn from suitable viewpoints. When in doubt as to clearance between certain parts drawn to small scale, necessary portions of these parts should be drawn to a larger scale in a separate lay-out. If, while drawing, an impression occurs of something which should be done on a drawing before it is complete, and yet which might be overlooked, a written note should be made of it. Careful consideration must be given the question

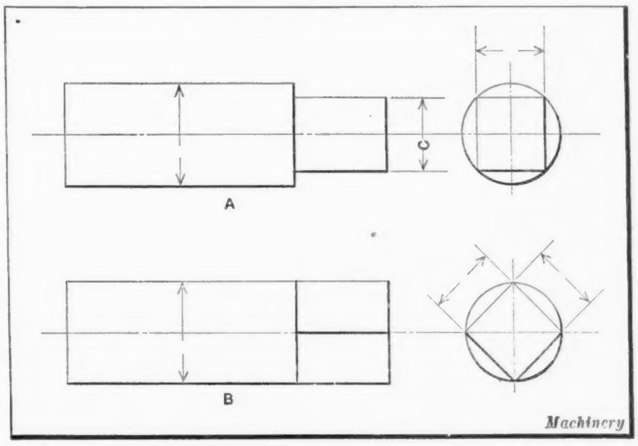


Fig. 7. When Part is dimensioned as at A, the Square End is sometimes turned to Diameter C; Dimensioning as at B prevents Such an Error

of alternatives in deciding upon the design of a part, its location in the machine, or the material to use. Frequently after a machine is made it seems desirable to change the material, design, or location of a part, because the part was made or located as first conceived without seeking for a possibly more logical alternative.

Refraining from crowding on drawings helps accuracy. Drawings should not be made to such a small scale that it is difficult to keep lines separated in tracing, or so that in dimensioning the figures have to be made so little that they are hard to make and read. When a detail contains parts that are so small that they are difficult to dimension, a separate enlarged view of this portion of the detail should be shown with the dimensions of the small parts given.

Clear Representation on Drawings

An attempt should be made to give correct first impressions in drawing, as the first impression may be acted upon without full investigation. Particular attention should be called to the unusual. It should not be the object to be only technically correct in a drawing but to be thoroughly understood. It has been found when the part in Fig. 7 is drawn as shown at *A* with the dimension of the squared end given at *C* that machinists sometimes turn the end round with a diameter equal to *C*. This danger of acting upon a wrong first impression has been eliminated by drawing the detail as at *B*. Likewise in Fig. 8 when the drawing is as shown at *A* the portion at *C* is sometimes turned with a diameter equal to *C*. By drawing the detail as at *B* with a section shown through the center, the machinist can hardly go wrong.

When Dimensions are not to Scale

If, after a detail is drawn to scale, it is found desirable to change the size or location of some part of the detail, this is frequently done by changing the dimensions only. In Fig. 9 the lug *A* is shown to the right of lug *B*, but by dimensions it must be located to the left of lug *B*. The width of lugs may be drawn 3 inches to scale and be dimensioned 2 inches. Leaving the width of the lugs out of scale is permissible. Even leaving the location of the lugs out of scale is probably permissible in such a simple case, but it is a doubtful time-saver when considering all the people who must use the drawing when first made and possibly many times in the future. It invariably brings up the question when the detail is seen alone, as to its correctness. It will probably be compared often with the detail with which it goes, to verify the dimensions which locate the lugs. Some engineering departments demand that a heavy

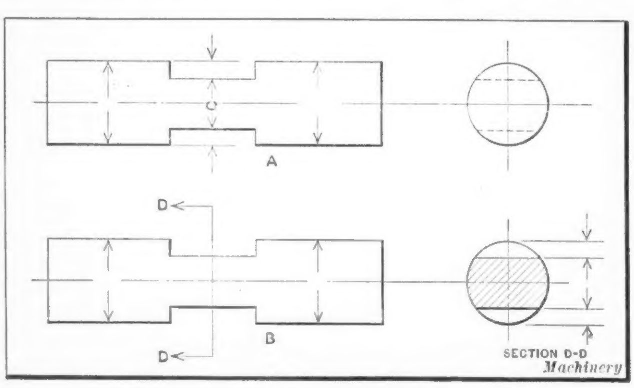


Fig. 8. Dimensioning as at B prevents Error of making Middle Part C Round, which is Likely to occur if dimensioned as at A

line be put under dimensions not to scale, and this helps the situation somewhat. However, in more complicated details leaving parts considerably out of scale regarding location prevents proper checking by graphical methods and perception of true relationships by merely looking at the drawing. The practice therefore does not help to promote accuracy. In using an old drawing of an assembly or detail as a basis of a lay-out to sketch in a proposed addition or alteration, any dimensions used should be checked to see if they are to scale.

Relative Locations of Different Views

The third angle of projection is used almost universally for machine drawings made in this country. The first angle is used sometimes in structural and architectural drawings. Whatever angle of projection is used by a concern must be strictly adhered to by all of its draftsmen. Likewise, drawing each detail as far as practicable in the same angular relation to the top of a detail drawing as it is shown on the assembly drawing helps to keep its relation to the assembly clearly in mind while drawing it, and thus helps to prevent error. If a part, like a diagonal brace, has its longest sides at an angle with the top of the assembly drawing it is, of course, permissible to draw the detail with these longest sides parallel with the top or side of the detail sheet. It is also legitimate for the sake of grouping parts with their longest dimensions parallel to turn a part, which is shown vertical on the assembly drawing, like a building column, to a horizontal position on the detail drawing. Some plants require that the bottom end of such a member drawn in a horizontal position shall always extend toward the left side of the drawing.

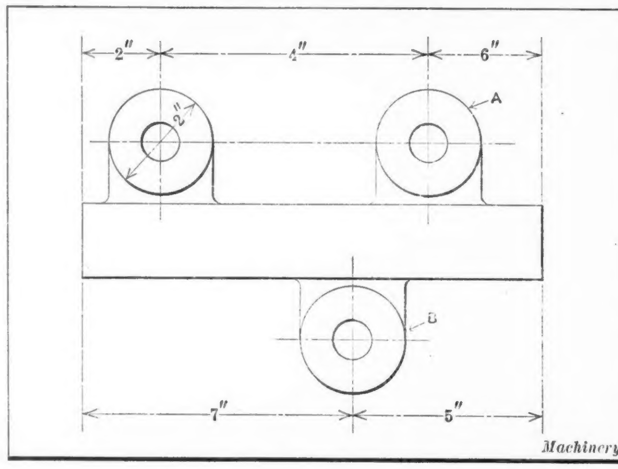


Fig. 9. Drawing with Dimensions which are not to Scale

Parts on a detail drawing should not be shown with the side elevation upside down from the position shown on the assembly drawing, for this invites error in the drawing of the part and is more difficult to check. If a bottom view is more essential than a top view, a top view should be shown at least in outline, and a bottom view should be shown under the side elevation. Likewise if the front view of a part is shown on the assembly, and the back view is not shown, and yet is the more important side when it comes to detailing, the front view should be detailed at least in outline, as it will help prevent the reversal in location of important parts in the back view. There are, of course, many simple cases where these top and front views are not needed to insure accuracy.

Explanatory Notes on Drawings

Notes on drawings must be prominent enough and so located that they will be seen at the right time—that is, they should be so closely associated with the part to which they refer that they will be seen when the part is being made. It is proper to place in a prominent position on a drawing a general note that will apply to all details on the drawing, such as "Punch all holes eleven-sixteenths inch unless otherwise noted." In such a case there is no authority for punching holes unmarked in size without referring to the general note. However, if it were desired to tap all holes shown on a drawing, with a thread different from that usually used, the change should not be covered only by a general

note as "All taps used to have sharp V-thread instead of U. S. standard." General notes should be and usually are read by a foreman before the drawing is given to a workman, so such a note may insure the use of sharp V-thread taps; but instead of indicating the size of hole in one place and special thread in another the kind of thread should be given with the size of each hole or group of holes, and must be made especially prominent.

Notes must convey correct and full information regarding the procedure to be carried out. In one instance a pattern had core-prints to core holes for 3/8-inch bolts around a flange. A purchaser desired to have one of these with holes cored large enough to use 1/2-inch bolts. Instead of changing the size of the core-prints, it was easier to make the casting with the smaller holes and ream them out with a drill to 9/16 inch diameter. The following note was therefore put on the bills of material and blueprints sent to the shop: "Drill 9/16-inch holes." The core-prints for the smaller holes made in the sand were therefore stopped off by the foundry, and the flange was cast solid, thus necessitating the marking of the position of the holes before drilling. The foundry was justified in doing this, as holes are usually drilled in solid metal, and the brevity of the note was such that it did not give the exact procedure to be followed. The note should have read "Ream cored holes in flange with 9/16-inch drill." After writing a note, one should read it to see what acts the note will cause to be performed without further knowledge of the job. What does each word call for a person to do?

An endeavor should be made to avoid dividing notes at vital points, placing a portion on one line and the rest on another line; for instance, when a note indicates a size 8" x 9" x 10", these figures should not be separated by placing 8" x at the end of one line and 9" x 10" at the beginning of the next. Unusual abbreviations that may not be understood by some of the persons who may use a drawing—say on a drawing to be used by the purchaser to erect a machine—should not be used. The letters I and O should not be used in notations; they look too much like the figures one and zero. If arrow lines running from notes are made diagonal, they show up better, as they are in greater contrast with most of the lines on the drawing. However, a line from a note should not run through a sectional view at the same angle as the section lines, as this obscures it. Arrow lines running from notes should not be crossed if it is possible to avoid it.

The next installment of this series of articles will continue the discussion of points to be observed in making drawings, in order to prevent errors in the finished part, taking up the matters of dimensioning and checking of drawings.

* * *

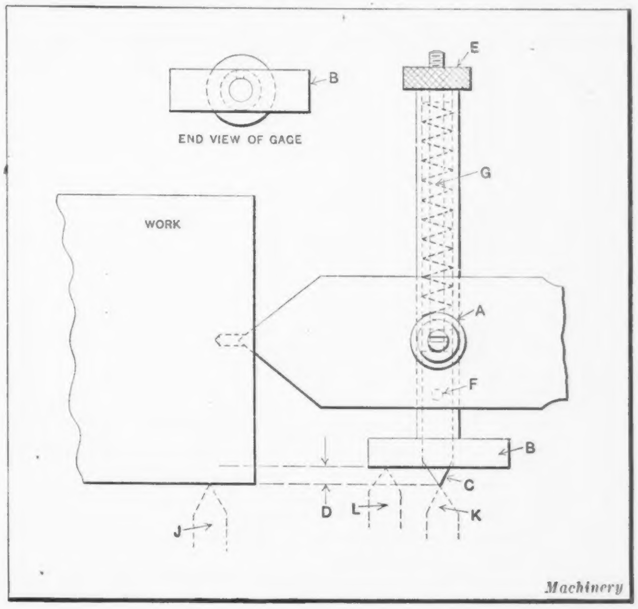
The necessity for manufacturers to combine for the purpose of carrying out research work is being recognized more and more all over the world. Abroad, various governments are also assisting in research work for industrial and engineering purposes. In Great Britain a special department of scientific and industrial research has been created, and the electrical and allied industries in Great Britain have availed themselves of the opportunity of cooperating with the government, and have formed an association known as the British Electrical and Allied Industries Research Association, which is to take over the work formerly done by the Research Committee of the Institution of Electrical Engineers and of the British Electrical and Allied Manufacturers Association. This research organization will have an income of about $75,000 a year to spend on research work, one-half of which is contributed by the British Government. If it were possible to establish practical working relations between the Bureau of Standards and the various manufacturing organizations in the United States, much might be gained in this country in the way of furthering research work.

GAGE FOR SETTING THREADING TOOL

By HARRY MOORE

In the accompanying illustration is shown a simple gage that has proved convenient when used in conjunction with a commercial thread gage for setting a thread-cutting tool. Those who have had any experience in cutting threads know that even when the work is turned to the correct outside diameter to start with, the burrs that are inevitably thrown up by the tool are quite likely to deceive the eye as to the exact depth of the cut, with the result that the thread must be finished to the final depth by cut-and-try methods, which requires considerable time.

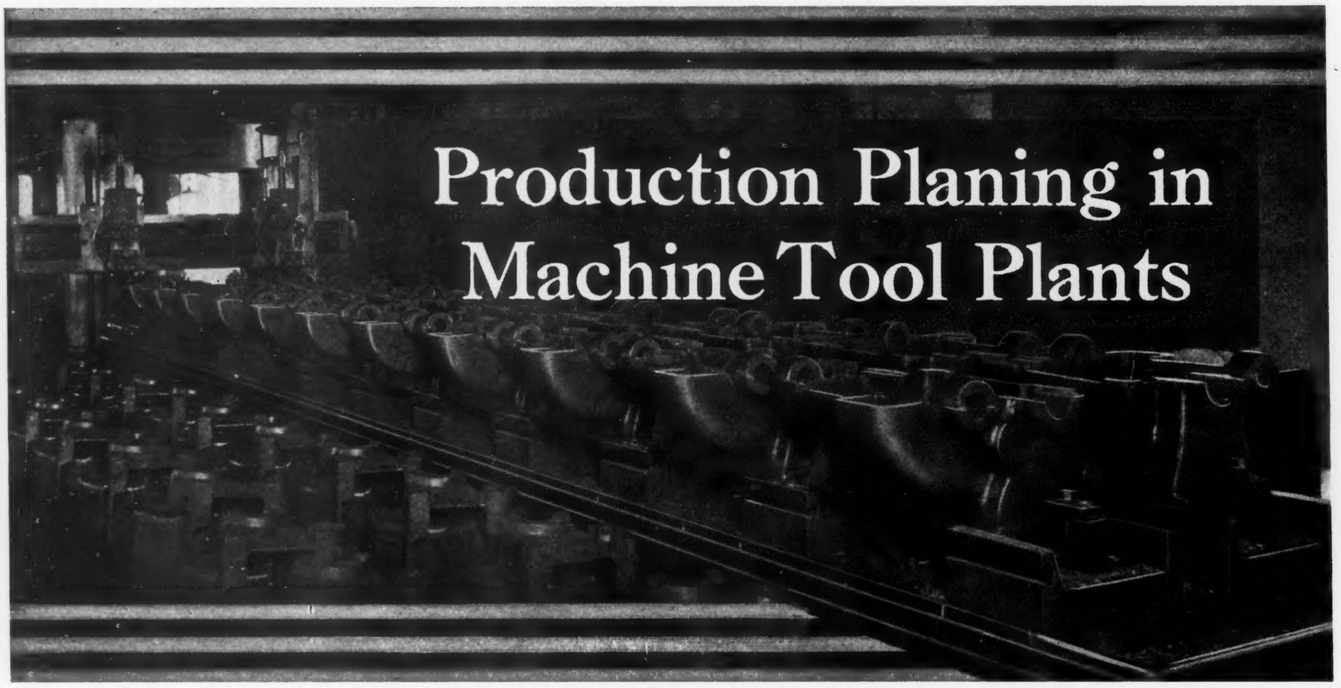
By the use of the gage shown in the accompanying illustration, however, the amount of material to be removed to cut a thread of the required depth can always be easily determined. In equipping a lathe with this gage, the tailstock center must have a 3/8-inch hole drilled through it at right angles to its center line. The shank of the gage is inserted in this hole and is held in place by a knurled head screw *A*. The body of the gage should be turned down



Gage for determining when Thread is cut to Required Depth

from 1-inch stock, leaving a collar at one end which is squared up as shown at *B*. A hole is then drilled through the shank of the tool to receive plunger *C*. The conical point of this plunger should be finished to an angle of 60 degrees. The other end of the piece is turned down to permit a spring *G* to be inserted as shown. The small end of plunger *C* should be threaded and provided with a knurled nut *E*.

When using the tool, a standard screw pitch gage is placed against the flat face of part *B* in such a position that the conical point of plunger *C* can be adjusted to fit one of the thread spaces in the gage. This adjustment is effected by knurled nut *E*. A pin *F* bearing on a flat surface of the plunger prevents the latter from turning when operating knurled nut *E*. It will be evident that point *C* projects beyond the face of piece *B* an amount equal to the standard depth of thread *D*, as determined by the standard gage. With point *C* set in this position, and the work turned to the correct outside diameter, the next step is to adjust the threading tool until its point just makes contact with the work, as shown at *J*. The carriage is next moved over until the point of the tool is opposite the conical point of the gage as indicated at *K*. The gage is then set in such a position that the conical point just makes contact with the point of the threading tool. The threading can now proceed in the usual manner. On the last or finishing cut, the tool should just touch the face of *B* as indicated at *L*.



Production Planing in Machine Tool Plants

Methods of Tooling up Planers to Expedite Rates of Output

IN previous installments of this series of articles on production planing, the statement has been made that planers are used for a great variety of operations, and it will be apparent to any experienced mechanic, even though he has not had the opportunity of familiarizing himself with details of the methods used in the performance of planing operations, that a variety of different types of tools are required for handling work of this kind. In planing, it is usually necessary to take three or more cuts on work where a high degree of accuracy is required, these cuts consisting of a roughing, a straightening, and a finishing cut. Castings and forgings which have to be planed usually come to the machine shop with a considerable amount of excess metal to be removed, and the roughing cut removes practically all of this surplus stock.

In taking a cut which may be anywhere from 1/4 to 5/8 inch or more in depth, it will be apparent that variations in the hardness of the work and other local conditions will cause the tool to spring to varying degrees, thus affecting the straightness of the surface produced by planing. The straightening cut is taken to correct these inequalities, a sufficient amount of metal being removed at this time to reduce the size of the work to such an extent that only a few thousandths of an inch remain for removal during the finishing operation. Tools used for the performance of roughing operations are of practically the same form on all classes of work, in most cases these tools being either round-nosed or square-nosed, the former type being most generally employed; but for straightening and finishing, the shape of the tool will vary over a wide range, according to the form of the work.

To attain maximum efficiency in the operation of a planer, careful attention must be paid to the design of the cutting tools and clamps that are used for holding the work in place; also, the accuracy of the foundation of the planer is a factor in determining the precision of the work that is produced. In this article, suggestions are given concerning the proper forms of cutting tools to use for the performance of roughing, intermediate, and finishing operations; data are presented on the proper working conditions to maintain in the taking of successive cuts over a piece of work; and information is given concerning the proper methods of setting up a planer, as well as of testing the accuracy of the planer foundation, and compensating for inaccuracies that may exist.

Types of Planer Tools Recommended by the G. A. Gray Co., and the Cincinnati Planer Co.

A comprehensive idea of the variety of forms in which planer tools are made will be gathered by reference to Figs. 1 to 4, inclusive, which illustrate tools that are used in the shops of the G. A. Gray Co., and of the Cincinnati Planer Co. Brief explanations of the purposes of these tools are presented beneath the illustrations, so that a detailed description is not called for elsewhere. In making planer tools, as in the production of tools for use on other types of machines, various methods are adopted for the saving of expensive high-speed steel. Tool-holders can be successfully employed on certain classes of work, while other shops find it more satisfactory to make their tools by brazing a high-speed steel bit to a carbon steel shank. Examples of tools made in accordance with this principle may be seen in the accompanying illustrations Figs. 1 to 4.

Another important point in this connection is the kind of steel from which the tools are made. For taking the roughing and straightening cuts, it is usually found that high-speed steel is the most satisfactory material, owing to its greater productive capacity; but where considerable accuracy and perfection of finish is required in performing the final planing operations, far more satisfactory results will usually be obtained by making the cutting tools of carbon steel, because this material can be ground to a keener edge, and experience has shown that the tools retain this edge longer and are thus able to produce a smoother and more accurate finish on the work.

Methods of Clamping the Work

Various methods are utilized for securing work to a planer table, but in most cases these are merely variations of the ways in which a combination of straps and bolts with their heads in the T-slots of the planer table may be employed to hold the work in place. By looking over the illustrations showing examples of planer practice in different shops, appearing in the different installments of this article, it will be seen that the methods of clamping work are matters in which the opinion of the planer foreman is allowed

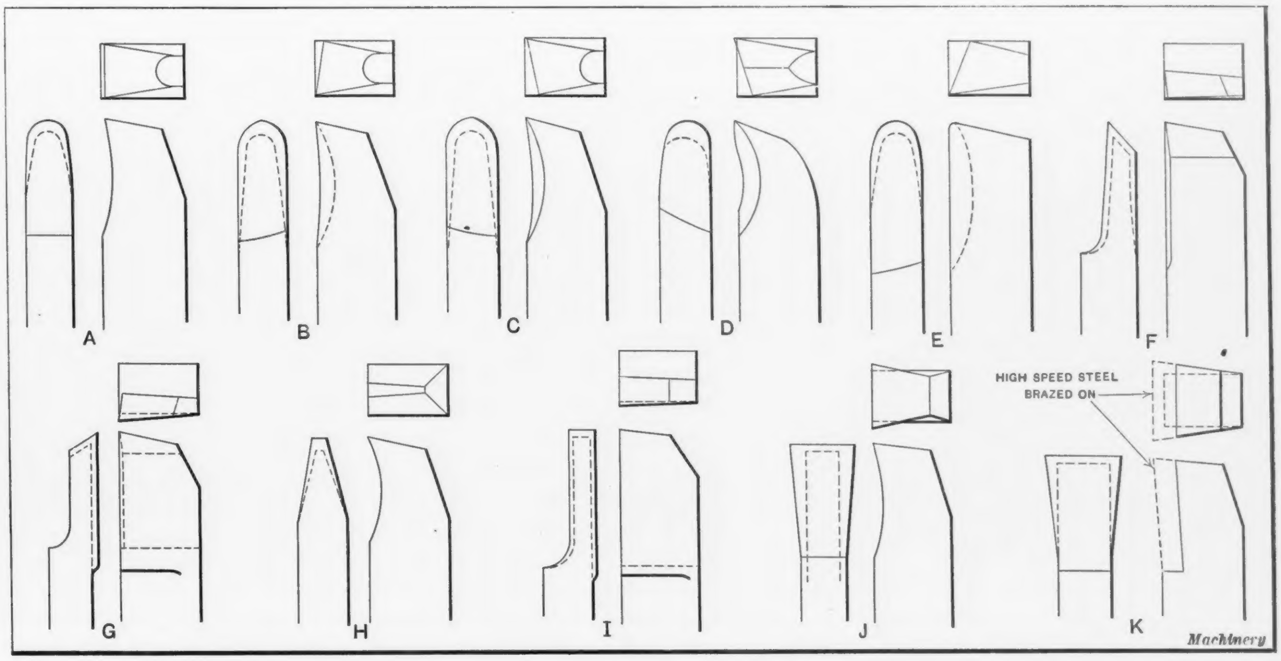


Fig. 1. (A) Roughing Tool feeds right to left or left to right; (B) Roughing Tool feeds left to right; (C) Roughing Tool feeds right to left; (D) Roughing Tool feeds right to left; (E) Roughing Tool feeds left to right; (F) V-bearing Finishing Tool made Right- and Left-hand; (G) Dovetail Finishing Tool made Right- and Left-hand; (H) Rough Beveling Tool; (I) Tool for finishing up to a Shoulder, made Right- and Left-hand; (J) Roughing Tool for Use with Vertical Feed; (K) Same as J, but with Brazed High-speed Bit. On All these Tools, Clearance behind Cutting Edge, 6 Degrees, and Side Clearance, 4 Degrees

considerable leeway. This is chiefly noticeable in the number of clamps which are used and in regard to the tightness with which they are held down. If there is any general criticism to be made of current practice in this part of the work of planer departments in even the most up-to-date shops, it is that an unnecessarily large number of clamps is used and that there is a tendency to screw down these clamps much tighter than is really required to fulfill existing conditions. It is true of a majority of examples of planing, but more particularly in cases where the work is heavy, that there is very little tendency for the piece to be lifted from the table. Consequently there is really no need to employ a large number of clamps, and those that are used need only be tightened up to a moderate degree. The practice of excessive tightening of clamping bolts is objectionable, because it is likely to distort the shape of the work that is being planed and also to pull the planer table out of shape, and either of these conditions is liable to result in the production of inaccurate work. In connection with this discussion of methods used in clamping work on a planer table, particular attention is called to the fact that in all cases the clamps should be located directly above the supporting blocks, when these means are employed for raising the work from the surface of the planer table, as this avoids danger of the pressure of the clamps distorting the form of the work.

In addition to the clamps that are used to overcome any tendency for the work to be lifted vertically from the table, various forms of stops are employed to resist the possibility of the work sliding endwise or sidewise. These stops may

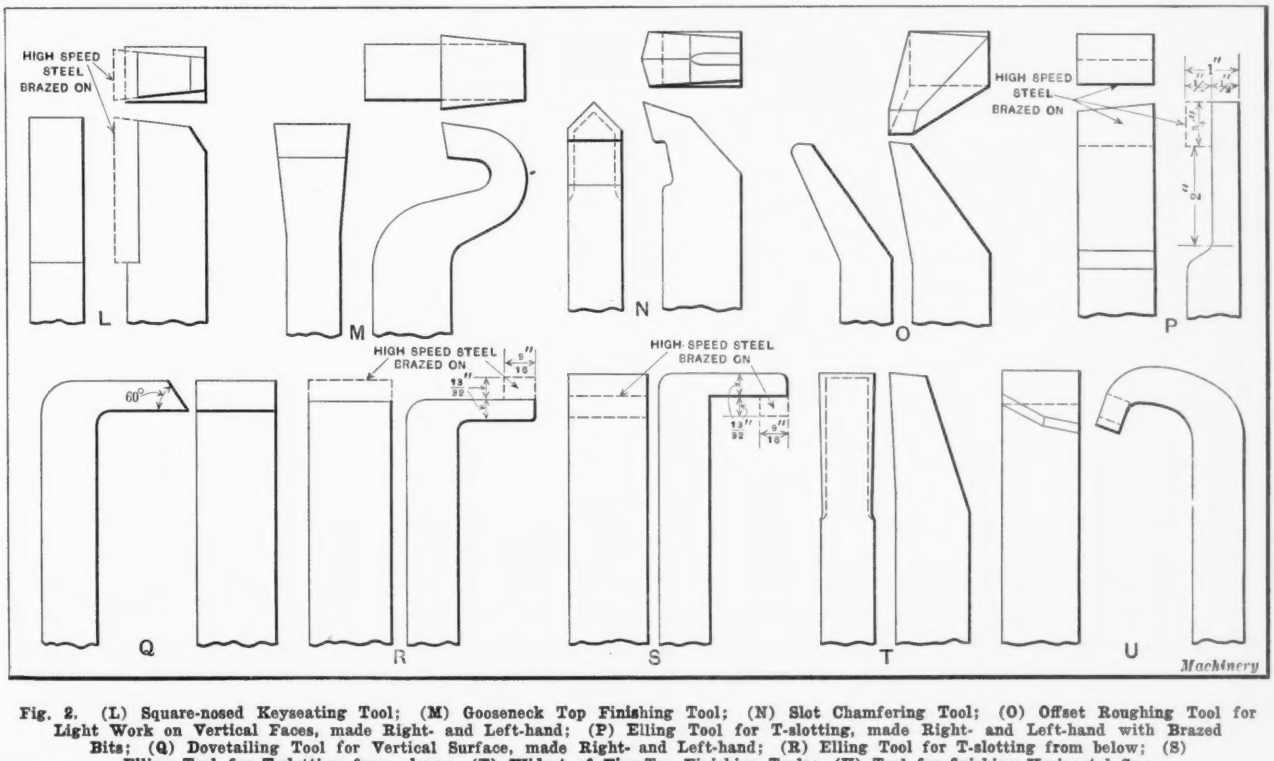


Fig. 2. (L) Square-nosed Keyseating Tool; (M) Gooseneck Top Finishing Tool; (N) Slot Chamfering Tool; (O) Offset Roughing Tool for Light Work on Vertical Faces, made Right- and Left-hand; (P) Elling Tool for T-slotting, made Right- and Left-hand with Brazed Bits; (Q) Dovetailing Tool for Vertical Surface, made Right- and Left-hand; (R) Elling Tool for T-slotting from below; (S) Elling Tool for T-slotting from above; (T) Widest of Five Top Finishing Tools; (U) Tool for finishing Horizontal Surface from below. On All these Tools, Clearance behind Cutting Edge, 6 Degrees, and Side Clearance, 4 Degrees

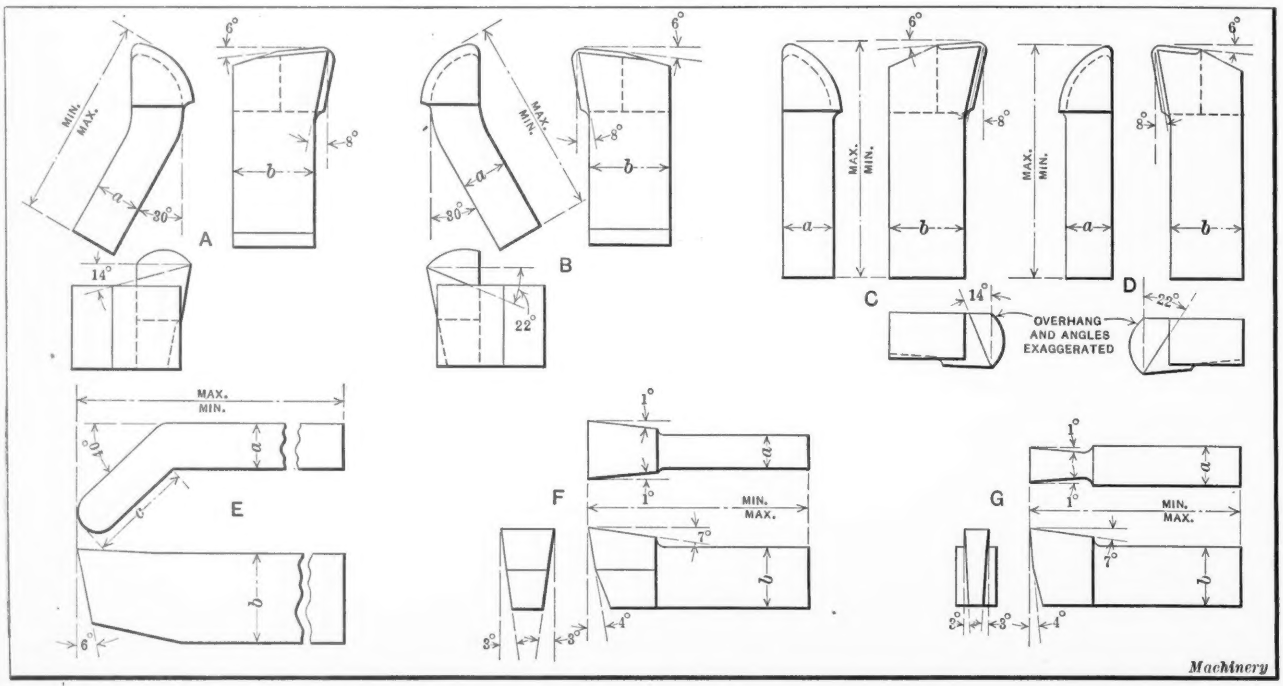


Fig. 3. (A) Blunt Round-nosed Bent Roughing Tool for Cast Iron and Hard Steel, made Right- and Left-hand; (B) Sharp Round-nosed Bent Roughing Tool for Soft Steel, made Right- and Left-hand; (C) Blunt Round-nosed Roughing Tool for Cast Iron and Hard Steel, made Right- and Left-hand; (D) Sharp Round-nosed Roughing Tool for Soft Steel, made Right- and Left-hand; (E) Bent Round-nosed Roughing Tool made Right- and Left-hand; (F) Broad Square-nosed Roughing or Finishing Tool; (G) Narrow Square-nosed Roughing or Finishing Tool. With the Exception of Tool E, all these Tools are made in Six Sizes with a, 1/2, 5/8, 3/4, 7/8, 1, and 1 1/4 Inches; b equals 2a; Minimum Length for all Tools, 4 Inches; and Maximum Length 11, 12 3/4, 14 1/2, 16 1/4, 18, and 21 1/2 Inches. Tool E is made in Two Sizes with a, 3/4 and 1 Inch; b, 1 1/2 and 2 Inches; c, 1 3/4 and 2 Inches; Minimum Length of Both Tools, 4 Inches; and Maximum Length, 14 and 16 Inches

be of various forms, the most familiar type consisting of a small post set in one of the holes drilled in the planer table for that purpose, and provided with a tapped hole through which a screw passes to come into contact with the work. Frequently, a practice is made of using a finger or so-called "butter" between the screw and the work, and some shops arrange these butters with a pointed end so that they may be inclined to exert downward thrust on the work, in addition to preventing it from moving laterally.

Importance of Using an Adequate Number of Stops in Setting up Planer Work

In connection with the foregoing statement concerning the inadvisability of using too many clamps, the reader is cautioned against confusing the terms "clamp" and "stop" as applied to planer work. The use of an adequate number of stops is absolutely essential because, particularly in the performance of rough-planing operations, the tools exert a heavy thrust on the work, owing to the depth of cut that they are taking. This lateral pressure must be resisted, and stops are provided for that purpose. The number of stops required will naturally vary according to the work, but usually there should be at least two stops at each end and two or more stops at each side of a casting to assure holding it in position. Then it will generally be found that one clamp at each end will be sufficient to hold the work down. Despite this fact, it is not unusual to see a large number of clamps used on work where two would be adequate; and for the reasons previously mentioned, the use of such a number of clamps is not only unnecessary

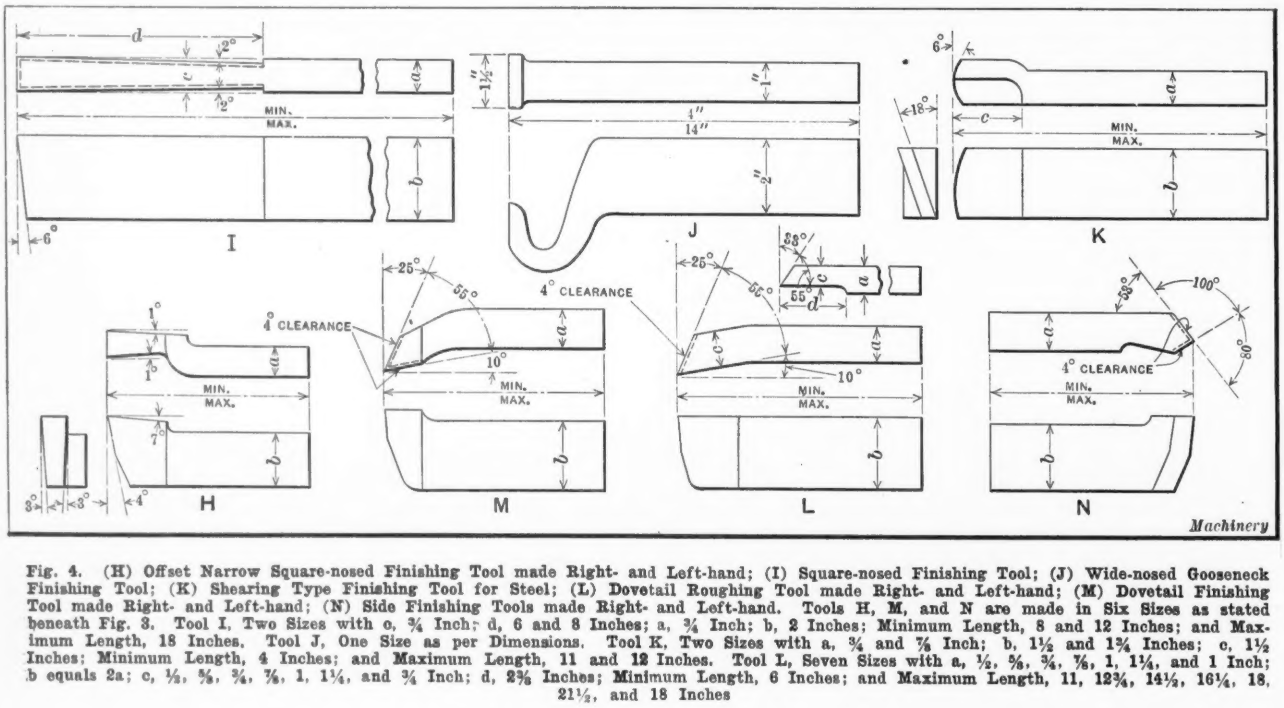


Fig. 4. (H) Offset Narrow Square-nosed Finishing Tool made Right- and Left-hand; (I) Square-nosed Finishing Tool; (J) Wide-nosed Gooseneck Finishing Tool; (K) Shearing Type Finishing Tool for Steel; (L) Dovetail Roughing Tool made Right- and Left-hand; (M) Dovetail Finishing Tool made Right- and Left-hand; (N) Side Finishing Tools made Right- and Left-hand. Tools H, M, and N are made in Six Sizes as stated beneath Fig. 3. Tool I, Two Sizes with c, 3/4 Inch; d, 6 and 8 Inches; a, 3/4 Inch; b, 2 Inches; Minimum Length, 8 and 12 Inches; and Maximum Length, 18 Inches. Tool J, One Size as per Dimensions. Tool K, Two Sizes with a, 3/4 and 7/8 Inch; b, 1 1/2 and 1 3/4 Inches; c, 1 1/2 Inches; Minimum Length, 4 Inches; and Maximum Length, 11 and 12 Inches. Tool L, Seven Sizes with a, 1/2, 5/8, 3/4, 7/8, 1, 1 1/4, and 1 Inch; b equals 2a; c, 1/2, 5/8, 3/4, 7/8, 1, 1 1/4, and 3/4 Inch; d, 2 3/8 Inches; Minimum Length, 6 Inches; and Maximum Length, 11, 12 3/4, 14 1/2, 16 1/4, 18, 21 1/2, and 18 Inches

but distinctly detrimental, especially if the clamps are tightened sufficiently to make it probable that they will either distort the work or the table of the planer on which it is set up. Fig. 5 illustrates two planer tables set up for planing in the plant of the G. A. Gray Co., and the arrangement shown in this illustration constitutes a good example of the judicious use of end stops and clamps.

Advantages Secured by Releasing All Work-holding Clamps before Starting to Finish-plane

In practically all shops where good planing is done, a practice is made of releasing the clamps and resetting the work between the performance of the rough- and finish-planing operations. This is always a desirable practice, and it is absolutely essential in cases where the shape of the work is such that there is a probability of the clamps distorting its form. As previously stated, the tools exert a considerable lateral pressure while taking a heavy roughing cut, and this is likely to cause the casting to move. Hence, the need of reasonably tight clamping. But for taking a light finishing cut, the tool pressure is greatly reduced so that it is unnecessary to have the work clamped as tightly, and it is most desirable to release the clamps and reset them to an extent sufficient for holding the work for the finish-planing operation. Where this precaution is not taken, a piece of work may be planed with a high degree of accuracy while it is still held in place on the table; but as soon as the clamps are released, it will be found that the work springs back to its normal position, and this distortion immediately destroys the accuracy of the planed job, regardless of the degree of precision that had been attained before the clamps were released.

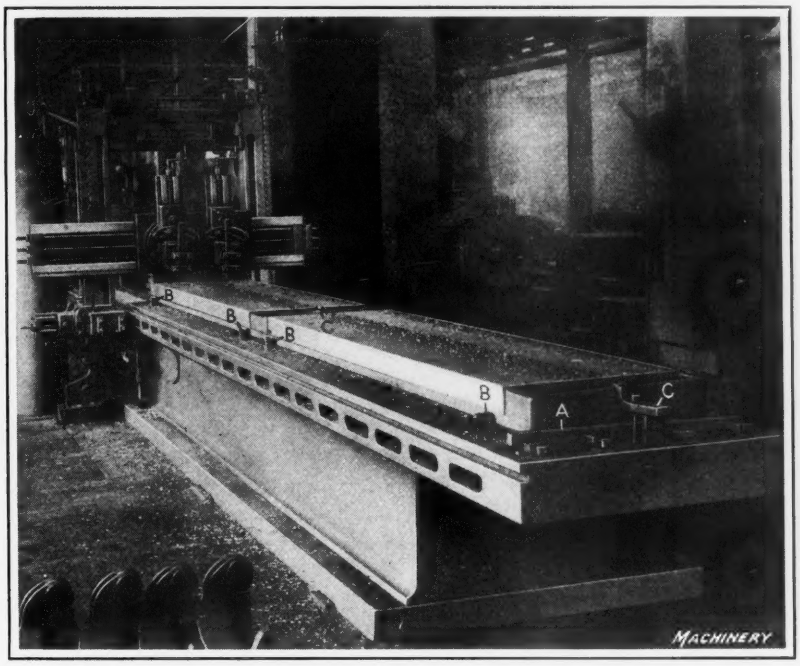


Fig. 5. Planer Set-up showing Judicious Use of Side and End Stops, with Dependence placed upon Weight of Work to assist in holding it down

In addition, it is sometimes found necessary to rearrange the packings placed between the supporting blocks and the under side of the work. This is necessary because the relieving of strains caused by removing the outer scale from the casting or forging is likely to cause slight readjustments in the form of the work, as a result of which all of the supporting blocks will no longer be carrying their due proportion of the load, regardless of the care that was taken in placing them under the work before the roughing cut was taken. It is attention paid to small details of this kind that makes the difference between a good job of planing and one that is of mediocre quality.

Tooling up Planers to Expedite Production

In general, it may be stated that the productive efficiency of planers as they are operated in many plants is not as high as that of other types of machine tools which are more extensively used for the rapid production of duplicate parts. Several factors are responsible for this condition, important among which is the fact that men in charge of the planning of machining operations have frequently had wider experience with the use of other types of machines. However, in addition to the large numbers of planers that are used on other than repetition work, there are sufficient examples of the possibilities of the planer for use in the manufacture of duplicate parts to commend a machine of this type to careful consideration at the time of deciding upon the form of equipment to be used for machining flat surfaces and certain forms of curved surfaces on castings, forgings, etc.

Almost invariably, it is required to take two or more cuts over a planed surface, and there are frequently a number of different surfaces to be planed on a piece of work, each of which requires the taking of more than one cut and the use of different types of tools for the performance of roughing, intermediate, and finishing operations. In order to be sure of obtaining satisfactory rates of production, detailed operation sheets should be furnished with the job tickets issued for each piece of work, explaining in detail the nature of the planing operations to be performed and stating step by step the order in which successive cuts should be taken, and the rates of cutting speed and feed to employ in each case. Where the length of the surfaces to be planed differs considerably or where there are short surfaces to plane at intervals along a piece of work, a point should be made of seeing that the operator resets the reversing dogs on the table so that time is not lost by having the tool "cut air" over a considerable length of table travel.

There is one very simple and apparently self-evident point in connection with the performance of planing operations that is frequently overlooked, and probably this is responsible for the loss of as much time in the planer department as any other one factor. Reference is made to failure of the shop management to provide plenty of blocks, packing, clamping bolts, washers, straps, and stops, etc., in a variety of sizes, so that the planer-hand is able to go to the tool-room and order these parts for a given job in just the same way that he would call for other tools that are essential for the performance of his work. This advice does not apply as definitely in the case of machines that are operated continuously on repetition work, because in such cases it is natural that the necessary clamping bolts and straps will remain at the machine, if it is not feasible to provide more elaborate work-holding fixtures that will assist the planer-hand in setting up his work. But in the case of shops which are using their planers on production work, although it is of a character that does not require to be handled in large quantities, the actual amount of time expended by a high-priced planer-hand in looking around the shop for the necessary means to clamp his work on the machine would be entirely disproportionate to the time actually spent in setting up and doing the job.

Economies Effected by Increasing the Number of Pieces of Work Set up on the Planer

Wherever such a method of procedure is feasible, experience has shown that important savings are effected through making provision for setting up a number of pieces of work on a machine at one time. This statement applies to work handled on milling machines, lathes, shapers, gear-cutting

machines, etc., and it is particularly true in the case of those jobs which are handled on planers. Naturally, the method of applying this principle of setting up more than one piece of work on a planer table will vary according to the shape and size of the pieces to be planed, but in a great majority of cases the procedure is to place a string of castings or forgings along the table of the machine, so that it carries them successively under the cutting tool.

Substantial saving of time is accomplished in this way for the following reasons: First, it is impossible to prevent a loss of time at each reversal of the direction of travel of the planer table, and two such reversals must occur for

TABLE 1. PLANING SPEEDS AND FEEDS FOR ROUGHING CUTS IN VARIOUS MATERIALS

Material	Cutting Speed, Feet per Minute	Feed, Inches per Stroke	Depth of Cut, Inches*
Cast iron	37–48	3/16	7/16
Cast steel	28–48	5/32	¼
Machine steel	28–48	5/32	¼

Machinery

*Note: Leave 1/32 inch of metal for removal by subsequent cuts. When so set, the tools tend to dig in and actually leave about 0.026 inch of surplus stock.

each working stroke. The time lost in this way is as great for a short as for a long stroke; so it will be evident that if a long string of castings is set up on the table, so that the parts may be planed progressively, the time lost by reversing the direction of table travel is distributed over this number of parts, instead of all being charged against a single piece of work. Consequently, this item of loss is reduced as the number of pieces mounted on the table is increased.

Second, multiple set-ups save time in setting the cutting tools, because it is necessary to change the tools a number of times for practically every piece of work, and as the same setting will provide for planing all of the pieces strung along the table, it will be evident that this item of loss is also reduced as the number of pieces that can be planed simultaneously increases. Third, in planing, it is necessary to so set the dogs that there is a certain amount of over-travel of the table in each direction. If only one piece of work is set up at a time, the same amount of over-travel is necessary that must be provided where a string of castings is set up for simultaneous planing. Hence, the multiple set-up also divides the time lost in over-travel by the number of pieces that are planed at a time, thus making the economy resulting from this method directly proportional to the number of pieces held on the planer table.

Limiting Factor in Applying Principle of Multiple Set-ups

As a general proposition, this principle of increasing the number of pieces of work set up on a machine at one time can profitably be applied until a point is reached where the number becomes so great that it is impossible for cutting tools used to perform one class of operation to complete their service without requiring regrinding. Then, the time lost in removing and replacing tools more than offsets the advantage resulting from the multiple set-up. Also, where special work-holding fixtures, clamps, etc., are required to hold the work, it would not be a profitable plan to provide a large number of such devices for holding a string of pieces

TABLE 2. PLANING SPEEDS AND FEEDS FOR STRAIGHTENING CUTS IN VARIOUS MATERIALS

Material	Cutting Speed, Feet per Minute	Feed, Inches per Stroke	Depth of Cut, Inches
Cast iron	45	3/16 to ¼	0.018
Cast steel	45	⅛	0.018 to 0.021
Machine steel	45	⅛	0.018 to 0.021

Machinery

TABLE 3. PLANING SPEEDS AND FEEDS FOR FINISHING CUTS IN VARIOUS MATERIALS

Material	Cutting Speed, Feet per Minute	Feed, Inches per Stroke	Depth of Cut, Inches
Cast iron	28–35	¼ to 1½	0.003 and 0.001*
Cast steel	45	1/32	0.004
Machine steel	45	1/32	0.004

Machinery

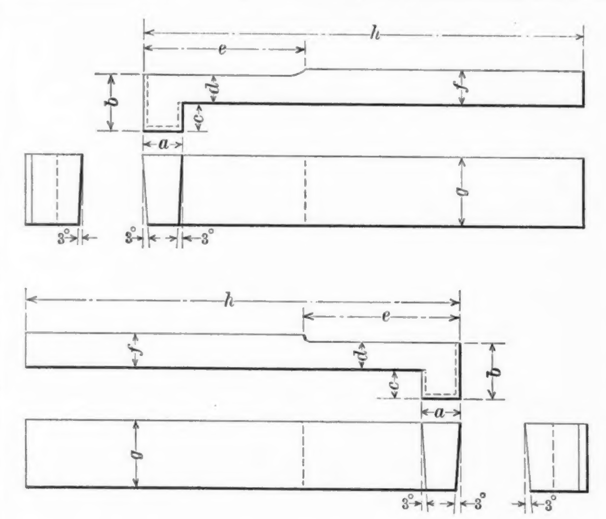
*Note: For finishing cuts on cast iron, it is good practice to divide the work up into two operations, taking off 0.003 inch with the first cut and 0.001 inch with the second cut. This prevents a tendency for the tool to dig in at the high spots.

on the planer table, unless the number of pieces of work to be handled were great enough so that the cost of such work-holding fixtures could be distributed over a sufficiently large number of pieces of work to reduce it within the limits of a reasonable item of expense.

Importance of Accurate and Solid Planer Foundations

Remarks which have been made concerning the flexure of large pieces of work, and in regard to the necessity of adequately supporting such pieces to prevent distortion, apply with equal force to the necessity of firmly and accurately supporting the bed of a planer in order that it may hold the table in correct alignment. This advice is of particular importance in the case of large planers, as any inaccuracy of the foundation will result in settling of the bed and consequent flexure of the table as it runs back and forth over bearings which are not in precise alignment. Evidently, it would be impossible to firmly support work on a table which is constantly changing form as it recip-

TABLE 4. DIMENSIONS OF ELLING TOOLS FOR PLANING T-SLOTS



a	b	c	d	e	f	g	h
5/16	½	¼	¼	1	½	1¼	14
11/32	11/16	7/16	¼	1	½	1¼	14
7/16	21/32	13/32	¼	1⅜	½	1¼	14
½	¾	7/16	5/16	1½	½	1¼	14
17/32	23/32	13/32	5/16	1⅝	½	1¼	14
9/16	25/32	15/32	5/16	1¾	½	1¼	14
11/16	⅞	9/16	5/16	2⅛	½	1¼	14
13/16	1	⅝	⅜	2½	⅝	1¼	16
15/16	1⅛	⅝	½	2¾	⅝	1¼	16
13/16	1 3/16	¾	7/16	3	⅝	1¼	16
1	1 3/16	⅝	9/16	3	⅝	1¼	14
17/32	2⅜	1⅜	1	0	1	2	12
⅝	3	2	1	0	1	2	14
¾	2½	1½	1	0	1	2	12
1⅛	1½	⅝	⅞	3½	1	1½	14
⅝	3½	2½	1	...	1	2	12

Machinery

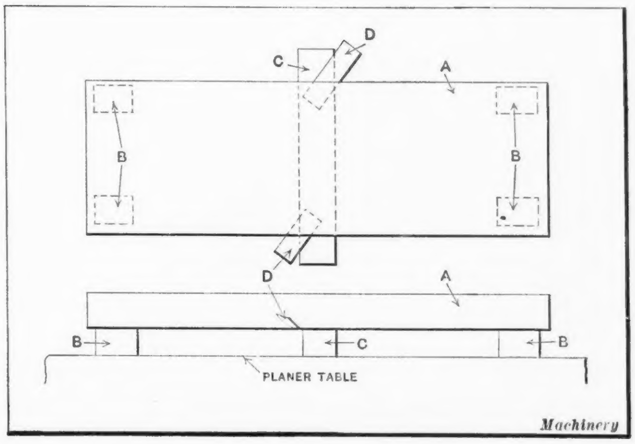


Fig. 6. Diagram illustrating a Convenient and Reliable Method of testing Accuracy of a Planer Foundation

rocates back and forth on the planer bed, and it has already been explained that without a solid foundation for the work, accurate results cannot be obtained in the performance of planing operations.

A few years ago, it was the practice to level up the bed of a new planer on the machine shop floor and then to set the bed in concrete, the idea being that this procedure would be the means of effecting a permanently accurate foundation. Subsequent experience has shown that this is not the case, and today all progressive shops make a practice of setting their planers on adjustable blocks so that the accuracy of the bed may be tested from time to time, and the foundation adjusted, as found necessary, in order to maintain it in true alignment. For holding large machines, several well-known planer builders manufacture special foundation plates, which afford means of easily compensating for any settling of the planer that occurs as a result of service.

In the case of small planers, it has been found to be entirely adequate to use two hard wood shingles under each leg. These shingles are placed with their tapers running in opposite directions, and when either leg of the planer has to be raised, this is easily done by tapping the thick ends of the shingles so that they are driven in opposite directions under the leg, the taper of the shingles causing the leg of the planer to be raised. Accurate adjustments may be effected in this way.

Test for Accuracy of a Planer Foundation

Fig. 6 shows in diagrammatic form a simple method of determining whether a planer bed is level. This is done by placing a piece of work *A* on four blocks *B* on the table of a planer whose foundation is to be tested. Midway between blocks *B* there is placed a parallel bar *C* of the same height, so that tissue-paper feelers *D* may be inserted between this bar and the finished under side of the work. The test is conducted by slowly moving the planer table along the bed and ascertaining whether feelers *D* are held with an equal degree of tightness at all points.

Evidently, if the foundation of the planer is inaccurate and the table tends to sag at various points as it reciprocates on the bed, such a condition will be revealed by the fact that feelers *D* can be pulled out when the portion of the table under parallel bar *C* has dropped even to a very slight extent. In conducting this test, work *A* should be of considerable length, in order to create a condition where the table is able to sag sufficiently over the distance between blocks *B*, so that any inaccuracy in the foundation is readily detected. Such an error is overcome by raising the foundation blocks beneath the planer bed at those points where it is found to be low. Planers maintained in this way should continue to give accurate results for a far greater length of time than those which are not subjected to a careful survey at regular intervals.

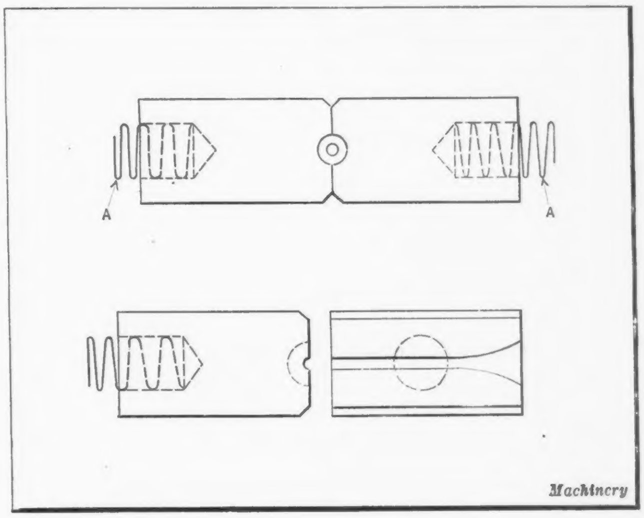
DIES FOR SWAGING SMALL WIRE

When pointing small wire in reducing or swaging machines, where the adjustment of the dies is not particularly close, or in some cases even with a close adjustment, the wire has a tendency, after the dies have passed the point of contact with the rolls and hammers, to jump out of the die groove and momentarily ride over the edge of the die. This roughens the end of the wire, causing chips to fly into the dies and from the dies into the roll cage. The amount of stock spoiled in this way and the labor wasted soon represent a considerable loss, especially if the wire is gold, gold-plated, or silver-plated.

The method of preventing this loss described in the following is simple and can be easily applied. It consists of placing small wire springs in the dies in such a position that the latter will be held in contact with the work at all times, thus preventing the work from riding up on the faces of the dies. It has proved especially useful in pointing very small wires and pin points.

The accompanying illustration shows two sets of dies equipped with springs as described. A hole is drilled in the bottom of each die, and an open-wound coil spring inserted in each hole and just caught in place with a little soft solder at the bottom of the hole to prevent it from falling out. The springs are shown at *A*, the holes in which they are placed in this particular case being 5/16 inch in diameter, and about 3/8 inch deep. These springs project beyond the bottoms of the dies from 1/8 to 1/4 inch. When these dies are inserted in the machine the springs being compressed force the dies together. This is a distinct advantage and will give excellent results on small tubing which is very likely to split or splinter unless handled by a highly skilled operator. With dies equipped as shown, unskilled labor can operate the machine at the maximum speed with a minimum of spoiled work.

Take for instance, a machine that is in first-class condition when starting operations on a large order of tubular parts which are required to be pointed; after the machine has run for a while the hammers or the backers become worn, the rolls wear down, and the adjusting stud that fits into the hammers or backers also wears a little, with the result that the dies open a little more as they spin around. Under these conditions, the tubing will begin to ride up on the edge of the die, and the splinters caused by this action will rough up the dies so that they will have to be fixed and the machine readjusted to obtain good results. With springs inserted in the manner described, the dies will have a longer life, and considerable time will be saved that would otherwise be required in making adjustments. T. E. W.



Dies equipped with Springs to prevent Work from riding up on Face of Dies

EFFICIENCY IN FOUNDRY CLEANING ROOMS

Overhead and labor charges are the two important cost items in the cleaning room of a cast-iron foundry, because the carbide of silicon wheels used for snagging the castings have a comparatively long life, and therefore the wheel cost per part produced is small compared to the labor and overhead charges for the part. A number of helpful suggestions for securing efficiency in cleaning rooms and the reduction of labor and overhead costs were given in an article by L. M. Krull, appearing in *Grits and Grinds*.

The amount of grinding to be done on a casting is in proportion to the excess metal left after the gates and fins have been knocked off, and so poor methods of making gates in molds result in excessive grinding. Where it is feasible, the gates should be molded instead of hand-cut and, in any case, they should be tapered so as to cause them to break off close to the point where they join the casting. It will be found that broad thin gates break more easily than thicker and narrower ones. Tumbling is the cheapest method of removing the sand from the general run of castings and, many fins and gates are knocked off in this operation.

Method of Handling the Work

An important point to observe is the method of handling the casting, the object being to keep the wheels of the grinding stand in contact with the castings as continuously as possible. The time spent in getting a casting to the grinding wheel and properly disposing of it after the operation should be kept at a minimum. This can be brought about by a good arrangement of the machines in the department, and an efficient system of trucking. The castings should be arranged in three groups—heavy, medium, and light. Large, heavy castings should be ground by means of swinging-frame or portable machines placed within easy reach of a crane. Castings from about 1½ to 60 pounds in weight should be snagged on floor stands, but castings smaller than 1½ pounds can be more economically handled on bench stands.

The feeding of the castings to the grinding machines and the removal of the finished pieces without interruption are first points to be taken into consideration, so that the work can be kept going continuously. To effect this, the small and medium sized castings should be placed within easy reach of the operator so that he can quickly grasp them with one hand and deposit them in a receptacle with the other, without requiring much movement of his body. Bench stands can be arranged along a wall upon solid benches, a bin being provided at the side of each wheel into which rough work can be readily shoveled. The operator can deposit the finished pieces into small kegs or boxes on the floor for removal by the truckman. The best arrangement for floor stands is in a line at a sufficient distance from a wall or from other machines, to permit boxes of castings to be fed to the machines from one side and taken away from the other.

Machines Should be Free from Vibration

The greatest success is obtained with any machine by having it run without vibration. When such is not the case, the wheel wears away because of the continual hammering, tending to make the wheel out of round. The operator then trues the wheel to remedy this condition, thereby wasting wheel material. Finally, depreciation and repair items become alarmingly great. Vibration can be greatly reduced by the use of heavy machines bolted securely to a concrete floor. Such an installation will absorb the slightly out-of-balance condition that any grinding wheel may inherently have or acquire when worn out of round.

Facts to be Considered in Selecting Grinding Wheels

The wheel used for an operation should be of such a bond strength that the grains will tear out of their setting when they become dull, and of such a grain size that the penetration is at a maximum unless a certain finish is required. Such a wheel would require little dressing for the purpose of sharpening the wheel face. The great factors that affect wheel selection are: The type and condition of the machine; the material from which the castings are made, and their size and shape; the speed of the wheel; and the personal factor.

Large castings generally require a coarser and harder wheel than small castings. This is because of the different pressures exerted by the operator, and because the inertia is greater. In general, the greater the mass of the casting in comparison to the mass of the wheel, the harder the wheel must be, other things being equal. Coarse grinding wheels remove metal most rapidly when the castings are soft, and, on the other hand, finer grained wheels are best for hard castings or castings having a hard skin. Another fact to be considered is the shape of the casting; thus, for example, on stove plates where the operation consists of removing sharp fins and flashes, and where the wheel edge is constantly used for cleaning corners, a finer, harder wheel must be used because of the dressing action and the small area contact of the work on the wheel.

By personal factor, is meant the operator's method of working. It is noticeable that men under a piece-rate system, use a grinding wheel more severely than those being paid by the day, and under such conditions of increased pressure and roughness, a harder wheel must be employed. For efficient running, a wheel should never run much less than 5000, nor more than 6000 surface feet per minute. Because of the importance of maintaining proper wheel speeds, many foundries have adopted a method of obtaining the correct speeds when the stands are not equipped with variable-speed motors or cone pulleys. This method is to use the same wheel successively on two or three different machines, each machine operating at a higher speed than the preceding one. For example, when a wheel 20 inches in diameter has been worn down to 16 inches in diameter when mounted on a machine on which the wheel-spindle operates at the rate of about 1125 revolutions per minute, it is taken off and mounted on another machine on which the spindle rotates at the rate of about 1450 revolutions per minute.

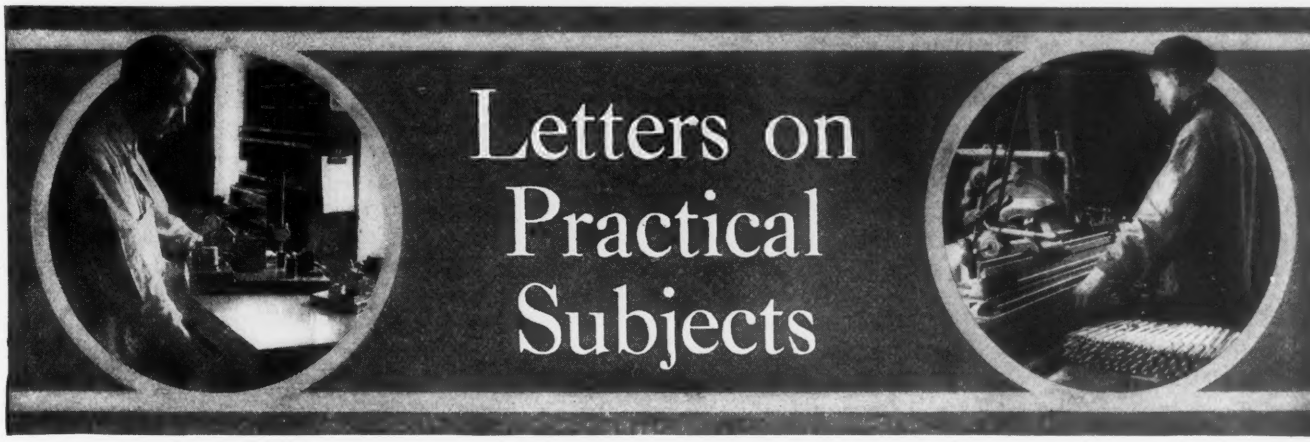
Piece- or Day-rate Pay for Operators

The operators in many cleaning rooms are still paid by the hour, but whenever a piece-rate system can be installed, it is advisable to do so, because the increased production is almost always remarkable. Even if only a production increase is the result, and the piece-rate is the same as figured from old performances at the day rate, there will be a large decrease in the overhead expense. If a record is kept by the foreman as to the performance of wheels and operators, it is easy to distinguish instantly the good and poor workman and to tell the average life and productiveness of various kinds of wheels. A record of this kind also enables the determination of the feasibility of instituting a piece-rate system and a fair idea of the rates which might be set under such a system.

* * *

PRESERVING JAMES WATT'S WORK-SHOP

The death of George Tangye, the founder of Tangyes, Ltd., has raised the question as to the permanent preservation of James Watt's work-shop. Mr. Tangye resided at Heathfield Hall, about three miles from Birmingham, England, for many years the residence of James Watt. The inventor of the steam engine had a work-shop in an upper story, where he was accustomed to spend a great deal of his time, and which was preserved by Mr. Tangye exactly as it was when Watt died, with the various tools lying just as he left them. This garret work-shop has been untouched for over 100 years, and it is proposed by the Watt Centenary Committee to take such steps as will preserve it for the nation.

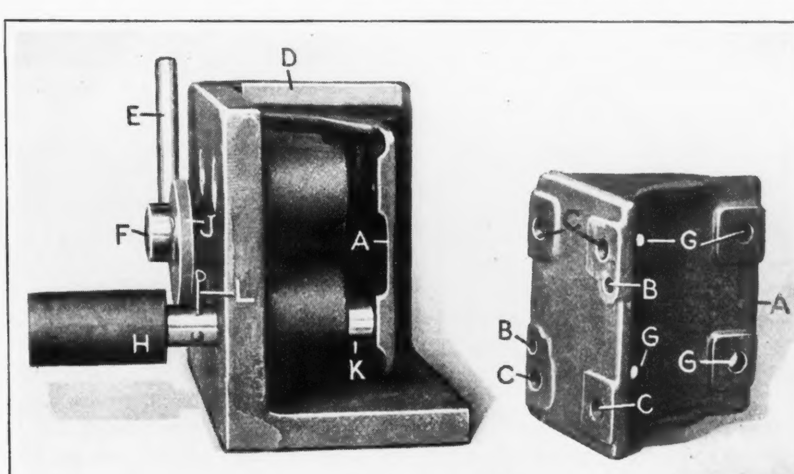


INSPECTION GAGE FOR GENERATOR BRACKET

The inspection gage shown at the left in the accompanying illustration is employed in the inspection of generator brackets used on a Paige automobile motor. One of the brackets *A* is shown at the right, while another bracket is shown in the gage in the position that it occupies during the gaging operation. The bracket is located by two dowel-pins which extend through plate *D* into holes *B*. Four pins also projecting from plate *D* check the location of holes *C*. Plate *D* is, of course, attached to the cast-iron body of the gage, and forms a flat surface on which the machined surfaces around holes *C* can rest. Thus it will be seen that plate *D* with its locating dowel-pins and checking pins corresponds with that part of the motor unit to which one side of the bracket is attached.

After placing bracket *A* in the gage in the position shown, handle *E* is swung over to one side. The movement of this handle rotates pin *F*, which extends through the gage casting. At the inner end of pin *F* is a cam which clamps the bracket to plate *D*, when handle *E* is swung over. The machined surfaces of the pads through which holes *G* are drilled are checked for their relation to dowel-pin holes *B*. by the flush-pin gage *H*, which also checks the spacing of these holes. One of the notable features of the gage is the positive action of the flush-pin. This pin carries a projecting pin *L* that passes under the mushroom shaped piece *J*. On the under side of piece *J* are two circular stepped faces, the outer step or face being 0.003 inch above the inner one, this being the tolerance allowed on the dimensions between the centers of dowel-pins *B* and the surfaces of the machined pads of holes *G*.

In using the gage, the piece is clamped over the two dowel-pins as previously mentioned, and flush-pin gage *H* inserted successively in each of the four holes in the gage. When the shoulder at the end of the pin comes in contact with the face of the pad as at *K*, the pin is turned, and if pin *L* passes partly under piece *J*, the work is within the 0.003 inch limit of accuracy. If the pin does not pass under, the distance is too small, and if it passes entirely under, the distance is too great. This type of gage leaves nothing to the judgment of the operator, and can be employed in many cases where it is desirable to maintain close limits of accuracy on work of the type here illustrated.



Inspection Gage for Generator Bracket

Detroit, Mich. J. LANNEN

MAKING FORMED TOOL FOR RELIEVING WORM-GEAR HOBS

The following simple method of making a formed tool for relieving a worm-gear hob was found to give satisfactory results. The thread of the hob in an axial plane was required to be straight-sided, with the sides at an included angle of 29 degrees. The dimensions of the hob were lead, 0.750 inch; pitch, 0.750 inch; outside diameter, 3.575 inches; pitch diameter, 3.022 inches; root diameter, 2.545 inches; and helix angle of thread, 4 degrees 31 minutes.

A disk of oil-hardening steel about 3 1/4 inches in diameter by 1 inch thick was turned up, and a 1-inch hole was bored in the center. The edge of this disk was next turned to approximately the shape of the thread, a shoulder being left at each side of the thread profile. A tool with a rounded point was used in this operation, which left the corners of the shoulders rounded to approximately the required radius so that only a light cut would be required in the succeeding operation. The difference between the outside diameter of the disk, and the shoulder diameter was made to equal twice the depth of the thread. The disk was next taken to a Cochrane-Bly No. 14 universal shaper. The milling spindle of this machine was swung to an angle of 4 degrees 31 minutes from the horizontal position. A 1-inch expanding arbor was then inserted in the spindle and the turned disk secured to it.

The circular table was placed on the table of the machine, and the compound circular table was placed on top of the circular table, with the transverse slide of the latter located at right angles to the line of travel of the machine table, and with the circular table at zero. A turning tool was next clamped to the top of the compound circular table, the height of the cutting edge being adjusted so that it would be at the same height as the center of the disk. The cutting end of this tool was ground to a radius equal to the radius required at the corners or points of the thread-forming tool to be produced.

The circular table was then turned to the right and set at an angle of 14 degrees 30 minutes. With the table set in this position the left-hand side of the disk was turned to the required form, using the transverse slide of the compound circular table. The circular table was then turned to the left and set at an angle of 14 degrees 30 minutes with the zero mark, and a tool similar to the one first used but of the opposite hand was employed to turn the right-hand side of the disk to give the correct tooth thickness at the pitch line, the thickness in this case being equal to $0.375 \times \cos 4$ degrees 31 minutes $= 0.3738$.

A Brown & Sharpe vernier tooth caliper was employed to determine the thickness at the pitch line or at a depth of 0.2387 inch. The corners of the tooth form at the outer diameter of the disk were next formed to the required radius. A 90-degree section of this disk was then cut away so as to form a cutting edge. The disk was then hardened and the cutting face ground along a radial line, after which it was placed on an arbor in a milling machine with the cutting face at an angle of 5 degrees from a vertical plane. A master form tool which had been roughed out was then held at a similar angle and the form shaved or planed to size by the disk cutter. The master form tool was then hardened and placed in a special fixture on the tool-head of a shaper at an angle of 5 degrees. The tool for relieving the hob was also set at the same angle on the shaper platen and planed to size by the master form tool. The tool for relieving the hob was then set in the relieving attachment of a lathe at the correct helix angle of the hob thread, in which position it was satisfactorily used to relieve the hob.

Lithgow, New South Wales, Australia JACK FINLAY

RELEASING THE LOCKED DIES OF A HEAVY POWER PRESS

A heavy power press of the type indicated in Fig. 1 had been set up for a forming operation on "motor scooter" wheels and was being tried out, when the press suddenly became locked, due to the placing of a blank of excessive thickness between the dies. The dies for the press had been made by an outside firm which had charge of the setting-up operation.

The press had a heavy flywheel *A*, which weighed about 1500 pounds. The energy of this wheel, running at 60 revolutions per minute, was transmitted through a pinion *B* and spur gear *C* having a ratio of 30 to 1. The machine was driven by an 8-inch belt running from a lineshaft to the tight and loose pulleys at *D*. The slide to which the upper die was attached consisted of two members *E* and *F*, as shown in Fig. 2, the inner member *F* being adjustable for different sized work by means of thickness plates *G*. This slide was operated through spur gear *C*, shaft *H*, and crank *I*, Fig. 1, the full pressure of the press passing through toggle *L*, and the bronze bearing block *M*, Fig. 2.

For this forming operation, the adjustment of the dies was required to be held to an accuracy of 0.001 inch, but it was almost an impossibility to obtain such a fine adjustment by the use of plates *G*. It was necessary that the forming operation be performed just as crank *H* of the press passed over the dead center, because the construction of the dies was such that no give or depression was permitted as the dies came together on the downward stroke. About six blanks had been formed and the press seemed to be working satisfactorily, when by some mistake a blank about 0.015 inch too thick was put into the press, thus preventing the crank from passing over the center and wedging the dies and work together. The force with which the dies became locked on the blank can be realized when the energy developed by the 1500-pound flywheel revolving at 60 revolutions per minute and transmitting its energy through gearing having a 30 to 1 ratio is taken into consideration.

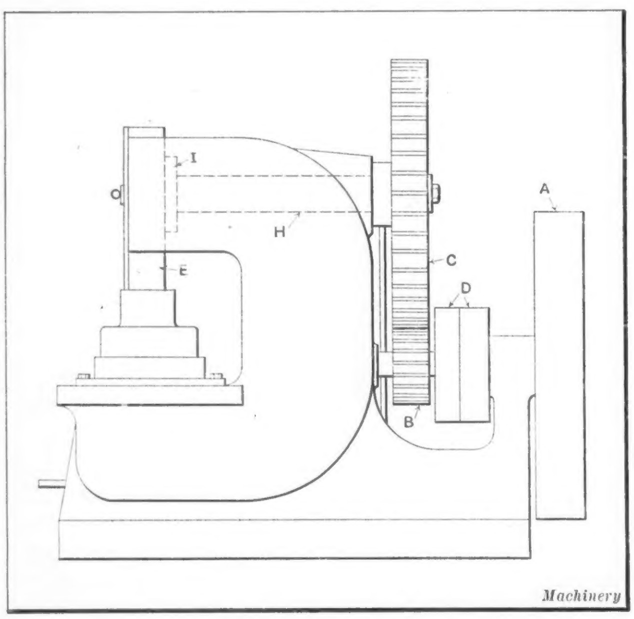


Fig. 1. Power Press which became Locked because of Insertion of too Thick a Blank

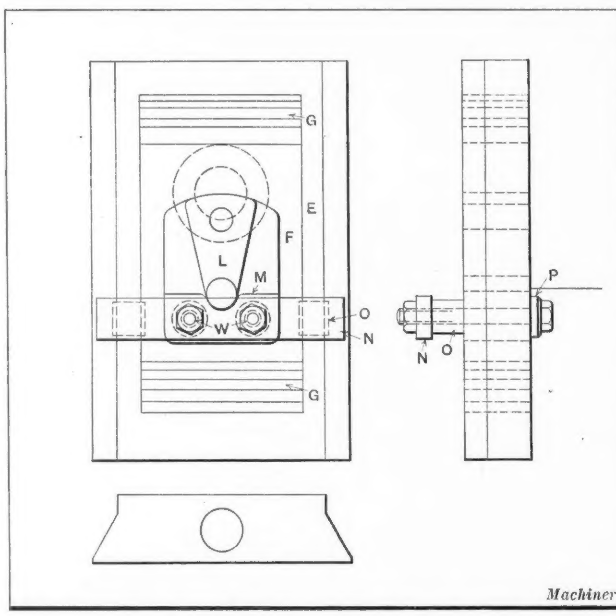


Fig. 2. Diagram illustrating Method employed to release Dies that became locked

The first attempt to release the press consisted of wrapping a heavy chain about the spokes of gear *C* and passing through this chain a 2½-inch steel bar 10 feet long in such a way that it could be employed as a lever. On this bar ten men exerted their strength in an endeavor to release the press but with no avail, as the bar simply bent. After this and several other methods had failed and the press had been idle for over a week, the writer worked out a plan for releasing the dies, which proved effective after about five hours had been expended in carrying out the work. Two 1¼-inch holes were first drilled through the bronze block *M* by the use of a ratchet drill. This permitted two bolts *W* to be passed through block *M* as indicated in Fig. 2. A steel plate *N* was next drilled and placed across the front of the slides. Two packing blocks *O* were put behind plate *N* and clamped in place by the two 1¼-inch bolts *W* which were provided with washers *P* under their heads. The nuts were then screwed down simultaneously by the use of two long-arm wrenches. After about ten complete turns, block *M* gradually began to slide out of part *F*.

The block was next soaked with gasoline, and after having renewed the bolts three times, the block was drawn out until its inner edge was within 1/32 inch of clearing the

slide. In this position the block was still held as tight as ever between the lower adjusting plates *G* and link *L*. It might be mentioned here that the width of the block was 4½ inches. When the block was nearly out, the matter of concern was whether the block would fly out or what would happen when the operation of drawing it out was continued. However, when the block was drawn to a position in which it lacked only a few thousandths inch of clearing the slide, it simply dropped out with a thud, and with the remainder of the loose pieces fell on a staging that had been erected for the purpose of catching them when the dropped out.

In order to determine the amount of deflection caused by locking the press, the writer had measurements taken before and after the piece was released from the press, and the deflection was found to be over 1/16 inch. The brass or bronze bearing block was removed as described without causing any mutilation that would prevent it from being put back in service. This method, therefore, not only proved effective in releasing the press, but also resulted in saving the cost of a new block which would have been required had other methods been employed. It may be mentioned here that the first holes drilled through block *M* were threaded for 1-inch studs, but when the first strain was placed upon the studs, they pulled through, thus necessitating the drilling of the 1¼-inch holes.

Cleveland, Ohio C. F. George

DETERMINING HEIGHT OF ARC WHEN MILLING KEYWAYS

When milling keyways or designing cutter-bars for broaching keyways, it is necessary to determine the height of an arc having a radius equal to one-half the diameter of the shaft or hole in which the keyway is to be cut, and a length of chord equal to the width of the keyway. This required dimension can be easily obtained by the following method, which is similar to one described in the December number of Machinery on page 377. The formula here given, however, only requires the use of a table of trigonometric functions containing sines and cosines, whereas the formula given in the December number requires the use of the cosecant and the versed sine functions, which are not always given in tables employed in the shop.

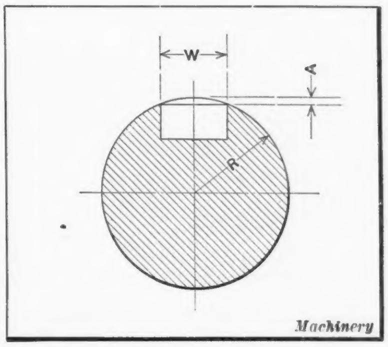


Diagram used in finding Height of Arc

Referring to the accompanying illustration, the width of the keyway is designated as *W*, the radius of the shaft or hole as *R*, and the required height of the arc as *A*. Let θ represent an angle, the sine of which equals

$$\frac{W}{2R}$$

Then

$$A = R - R\cos\theta$$

To find *A*, locate sine θ in a table of natural trigonometric functions, and on the same line find cosine θ. Multiplying cosine θ by *R* and subtracting this product from *R* gives height *A*.

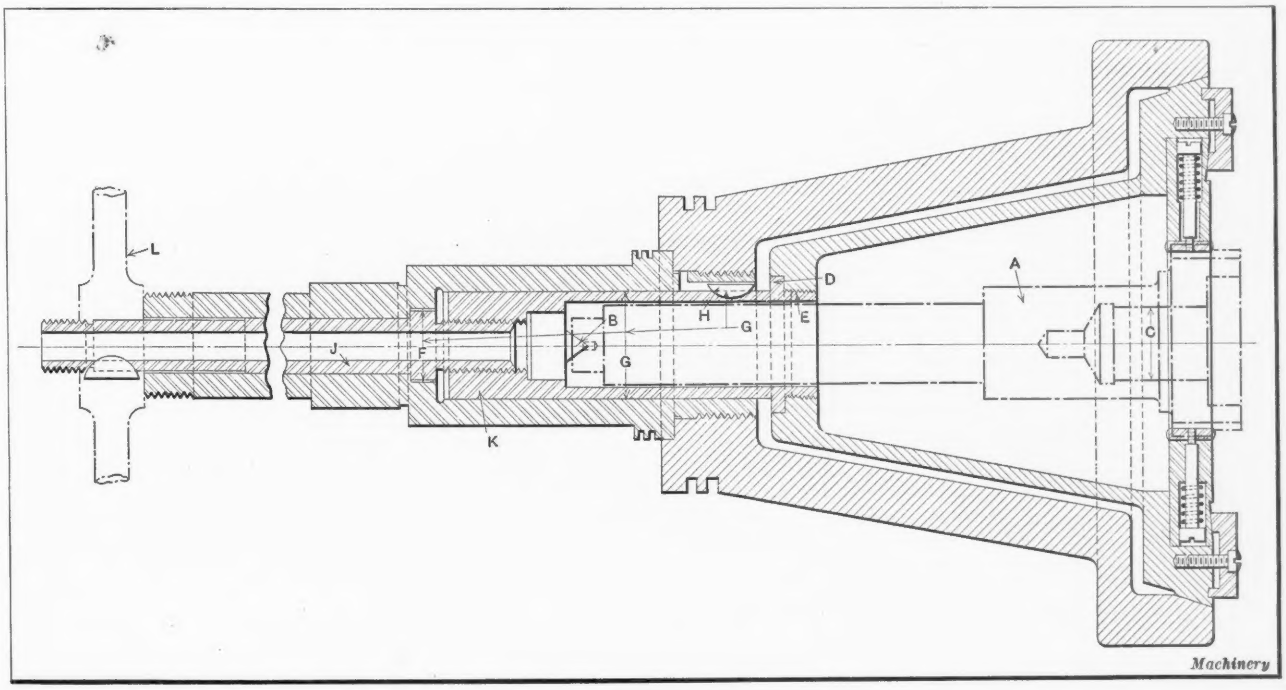
Detroit, Mich. Palmer Hutchinson

GRINDER CHUCK FOR HOLDING CLUTCH GEAR SHAFT

The accompanying illustration shows how the standard chuck of a small-size Bryant internal grinder was redesigned to hold the clutch gear shaft *A*. The gear-shaft is 12¾ inches long, and the hole at *C* must be ground concentric with the pitch circle of the gear teeth, and parallel with the center line of the shaft. From the illustration it will be seen that the shaft is located and supported at one end by a center *B*, while the other end on which the gear teeth are cut is held by the Bryant standard pitch-line control jaws, which make contact with the gear teeth at the pitch circle.

In redesigning the standard chuck to accommodate the work, it was necessary to enlarge the counterbore at *D* and the threaded hole at *E*. The diameters *F* and *G* of the hole in the spindle were also increased, and a key *H* provided as shown. A new draw-bar *J* and a special draw-bar head *K*, fitted with a center *B*, were also required. In order to grind hole *C*, the work *A* is inserted in the chuck and forced back until the small end is located in position by center *B*. The work is held in this position by the wheel-spindle arm until the operator tightens the handwheel *L* at the end of the draw-bar, which causes the pitch-line control jaws to grip the work, thus holding it firmly in place.

Pittsburg, Pa. William Owen



Grinder Chuck which was redesigned to hold Clutch Gear Shaft

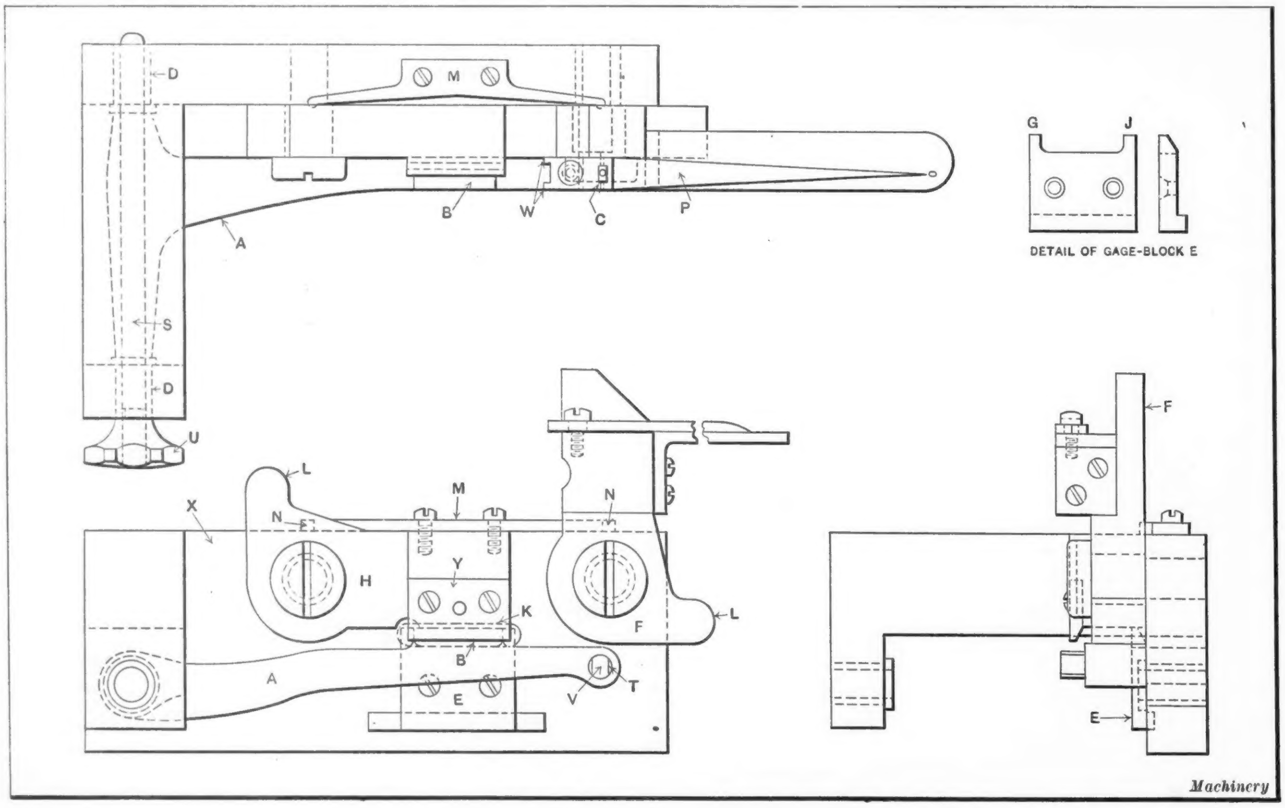
GAGE FOR TESTING ACCURACY OF MILLED SURFACE

The small machine part shown at *A* in the accompanying illustration was required to be milled on surface *B*. It was necessary for this surface to be parallel with the shaft hole *S*, and in a specified relation to this hole and the small hole at *T*. The gage in which the piece is mounted was made for the purpose of rapidly checking the accuracy of the milled surface. The gage consists primarily of a piece of machine steel *X* forged to shape and machined all over; two hardened and ground steel bushings *D;* a locating pin *U;* a stationary locating plug *V;* and two swinging gage-blocks *F* and *H*.

When swung into position for gaging, the outer end of block *F* rests on point *G* of block *E*. When swung into a similar gaging position, the outer end of block *H* rests on point *J*. Hinged block *F* is provided with a pointer *P* which indicates the degree of parallelism between the surface milled and the main shaft hole *S*. Block *H* is provided with a straightedge which shows whether or not the surface has been finished to meet the requirements as regards its position relative to holes *S* and *T*. A slot is cut through the main forging to admit light so that the inspector can observe the condition of the finished surface and more readily compare it with the straightedge. The swinging blocks, as will be noticed, are hinged or pivoted on large bearings made in the form of shouldered studs fitted snugly in the reamed holes of the blocks.

The knobs *L* on swinging blocks *F* and *H* serve as handles by which the blocks can be easily thrown in or out of the gaging position. The spring *M* is provided with knobs at each end which drop into notches *N* in blocks *F* and *H* for the purpose of holding the blocks upright when they are not in use. It will be noted that indicator *P* is provided with a slot at *C*, and that a pin in this slot limits the movement of the indicating point. When block *F* is swung over, the two contact points *W* at the lower end of the indicator arm come in contact with the finished surface of the work, and cause the indicating point to deviate from the zero mark if the machined surface is not parallel with the axis of hole *S*. When block *H* is swung into a gaging position, the lower edge of block *Y* coming almost in contact with the surface of the work, permits the inspector to determine if the height and straightness of the milled surface is within the required limits of accuracy by noting the amount of light that is visible between the milled surface of the work and the block *Y* of the gage.

Devon, Conn. CHARLES W. OVIATT



Gage for testing Accuracy of Milling Operation

CYLINDER BORING FIXTURE

The cylinder-boring fixture described in the following was designed by the writer for use on a Colburn drilling machine. Before performing the boring operations, the cylinder castings are ground on both ends and drilled for attaching to the crankcase. This permits the castings to be accurately located by pins set into the rotary indexing table of the fixture, which holds four single- or two twin-cylinder castings. The fixture is attached to the bed of the drilling machine in such a manner that the cylinder castings can be successively indexed into position for performing the boring operations.

The first roughing tool is not changed until the fourth cylinder is bored. After replacing the first roughing tool and performing the second rough-boring operation on the four cylinders, the finish-boring tool is placed in the spindle and the finish-boring operations performed. As soon as one cylinder casting is completed, it is removed and replaced with a rough casting, so that the machine can be kept at work continuously.

One advantage resulting from the use of this fixture is that the cylinder castings have a chance to cool between the roughing and finishing operations, as three castings must be bored before the first one has been indexed to the starting point for the next operation. The tools are held in a quick-change chuck. The spindle is provided with a sliding steadyrest which is attached to the column of the machine.

Toronto, Canada J. J. LINTON

HOW AND WHY

QUESTIONS ON PRACTICAL SUBJECTS OF GENERAL INTEREST

TOOLMAKER'S PROBLEM

L. M. S.—Referring to the accompanying illustration, please show how to find the distance x between the 3/16-inch plugs.

ANSWERED BY GEORGE WARMINGTON, BEVERLY, MASS.

The dimension x can be found in the following manner: In triangle OKL,

$$OK = \sqrt{1.875^2 - 0.750^2} = 1.7185 \text{ inches}$$

In triangle CKL,

$$CK = LK \times \cot 25 \text{ degrees} = 0.750 \times 2.1445 = 1.6084 \text{ inches}$$

$$OC = OK - CK = 1.7185 - 1.6084 = 0.1101 \text{ inch}$$

Draw line OB parallel to CF, making angle COD equal 25 degrees.

Now,

$$FB = CD = OC \times \sin 25 \text{ degrees} = 0.1101 \times 0.42262 = 0.0465 \text{ inch}$$

and

$$EB = EF + FB = 0.0937 + 0.0465 = 0.1402 \text{ inch}$$

Also,

$$OE = 1.875 - 0.0937 = 1.7813 \text{ inches}$$

Therefore,

$$\text{Sin } EOB = \frac{EB}{OE} = \frac{0.1402}{1.7813} = 0.07871$$

Hence angle EOB = 4 degrees 30 minutes 50 seconds or approximately 4 degrees 31 minutes

Now in triangle HOE, angle $HOE = COD - EOB$ = 25 degrees — 4 degrees 31 minutes = 20 degrees 29 minutes

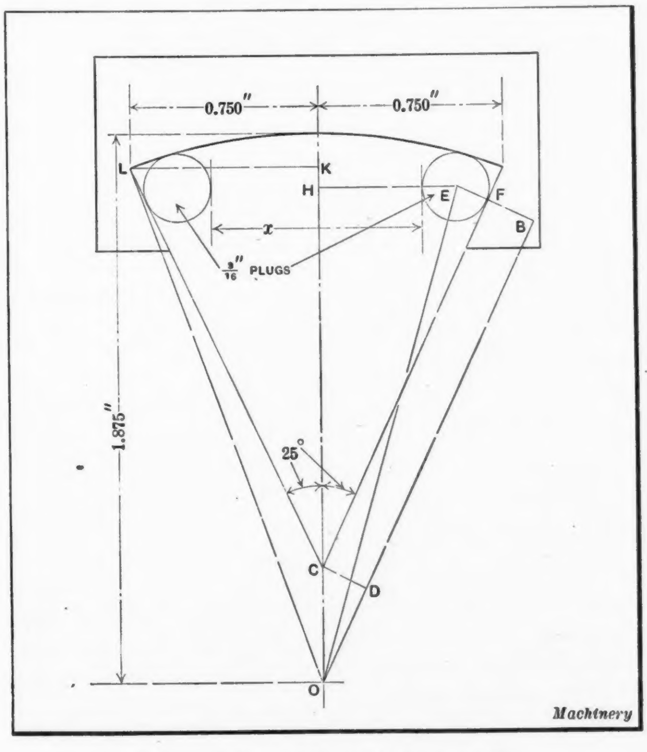


Diagram used in solving Toolmaker's Problem

and $HE = OE \times \sin 20$ degrees 29 minutes $= 1.7813 \times 0.34993 = 0.6233$ inch

Therefore,

$$\frac{x}{2} = HE - 0.0937 = 0.6233 - 0.0937 = 0.5296 \text{ inch}$$

and

$$x = 2\ (HE - 0.0937) = 2 \times 0.5296 = 1.0592 \text{ inches}$$

MATHEMATICAL PROBLEM INVOLVING HORNER'S METHOD

W. A. M.—The accompanying diagram shows a triangle ABC superimposed on the triangle AFC. The angle α is common to both triangles. If the sum of sides c and x is 15 inches, the length of side a 4.5 inches, and the length of side h 5 inches, how can the length of sides x and y be determined?

ANSWERED BY W. W. JOHNSON, CLEVELAND, OHIO

A.—Let $c + x = s$. From the triangle ABC,

$$a^2 = x^2 + c^2 - 2xc \cos \alpha$$

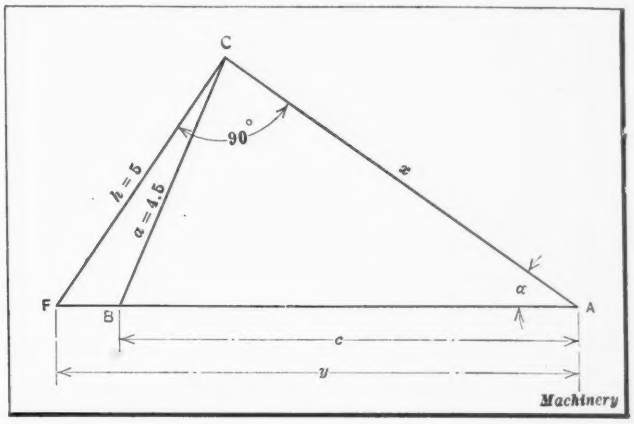


Diagram used in the Solution of the Problem

But if $s - x = c$, then

$$a^2 = x^2 + (s - x)^2 - 2x(s - x) \cos \alpha \qquad (1)$$

From the right triangle AFC,

$$\text{Tan } \alpha = \frac{h}{x}$$

From trigonometry we have the relation:

$$\text{Cos } \alpha = \frac{1}{\sqrt{1 + \tan^2\alpha}}; \text{ then } \cos \alpha = \frac{x}{\sqrt{x^2 + h^2}}$$

Substituting this value for cos α in Equation (1), we get

$$a^2 = x^2 + (s - x)^2 - 2x(s - x) \frac{x}{\sqrt{x^2 + h^2}}$$

Clearing of fractions, factoring, and transposing,

$$\sqrt{x^2 + h^2}[x^2 + (s - x)^2 - a^2] = 2x^2(s - x)$$

Squaring both sides of the equation,

$$(x^2 + h^2)[x^2 + (s - x)^2 - a^2]^2 = 4x^4(s - x)^2$$

and expanding,

$$(x^2 + h^2)[4x^4 - 8sx^3 + 4(2s^2 - a^2)x^2 - 4s(s^2 - a^2)x + (s^2 - a^2)^2] = 4x^6 - 8sx^5 + 4s^2x^4$$

Expanding, transposing and arranging terms,

$$4(s^2 - a^2 + h^2)x^4 - 4s(s^2 - a^2 + 2h^2)x^3 + (s^4 + a^4 - 2a^2s^2 + 8h^2s^2 - 4a^2h^2)x^2 - 4h^2s(s^2 - a^2)x + h^2(s^2 - a^2)^2 = 0 \qquad (2)$$

Substituting the known values in Equation (2) we obtain,

$$919x^4 - 15285x^3 + 84897.5625x^2 - 307125x + 1048064.0625 = 0$$

Solving this equation by Horner's method, we find

$$x = 7.22785 \text{ inches}$$

From the right triangle AFC,

$$y = \sqrt{h^2 + x^2}$$

Substituting the value just found for x in this equation,

$$y = \sqrt{77.241815} = 8.78873 \text{ inches}$$

The British Machine Tool Industry

From MACHINERY'S Special Correspondent

London, May 12

AT the present time it is not easy to take comprehensive views and still more difficult to make definite statements regarding the conditions and prospects of the machine tool trade in this country. As far as home trade is concerned, nearly every one agrees that the depression is profound, and recent indications of brightening have been temporarily lost to sight. Against this, however, the export trade, judging by the official returns, has never been in so flourishing a condition.

Unprecedented Increase in Export Trade

The overseas trade returns for the first quarter of the present year are instructive, when compared with similar periods ranging over the last ten years. From the point of view of total tonnage, imports have fallen to the low figure of 1454 tons, but exports have risen to the unprecedented total of 7231 tons. This seems to indicate that we are maintaining our supremacy in heavy machines. We are rapidly attaining a figure representing double the pre-war export tonnage.

From the point of view of total values we have reached a figure substantially more than four times the pre-war level in exports of £232,000 ($928,000, present exchange) although the value per ton is not quite two and a half times the pre-war level. There is a gradual rise in the value per ton of imports, and this probably indicates that foreign makers find their market in this country becoming more and more restricted to special machines commanding high prices. The relative position with regard to exports and imports can be summarized by saying that for every 100 tons of machine tools imported we are exporting 499 tons, and for every £100 ($400, present exchange) in value of machine tools imported we export to the value of £277 ($1108). The value per ton of imported machine tools is £265 ($1060), whereas tonnage exported is valued at £175 ($700) per ton. Satisfactory as these figures appear on the surface, it is felt that they cannot continue at this level.

It is interesting to note the character of the machines referred to in these returns. During March this country shipped for export 101 grinding machines, whereas only 9 were imported; 125 milling machines were exported and only 6 imported. Only in drilling machines were more machines imported than exported, the numbers being 188 and 159, respectively. The classified monthly return points to the fact that this country can compete in and satisfy demands for nearly every class of machine tool, a preponderance, however, being shown in lathes. A feature within recent times has been an increasing inquiry from Japan for British machine tools. The naval dockyards there have always favored the production of this country, and at present there seems to be a certain activity demanding an increase in their plant. The Indian market is uncertain and hesitating, and although there are numerous and apparently quite bona fide inquiries from Calcutta and Rangoon, very few of them come to maturity.

Labor Conditions

It is now felt that reductions in wages are an immediate necessity. The protraction of the present coal strike is causing the elucidation of the whole economic structure of this vital industry, and it is patent that it is no longer simply a question of profits, since even the waiving of the whole of these would do little to outweigh the adverse balance, under the present circumstances, and there is no alternative to wage reductions but state subsidies—a totally unsound procedure.

Conferences are taking place between representatives of the Amalgamated Engineering Union and kindred organizations, and the Engineering and National Employers Federation to discuss the question of reduction of wages. The proposals include a reduction of 6s ($1.20, present exchange) a week on time rates and 15 per cent on piece-work rates, together with the abolition of the bonuses of 12½ per cent on the earnings of time-workers and 7½ per cent on the pay of piece-workers. It is understood that it was represented on behalf of the men that the proposed reductions were not warranted, having regard to the rate of wages paid to workers in other trades which did not require higher or equal skill.

It was further claimed that the rate of remuneration paid to the skilled machinists was not commensurate with the value of the engineering products to industry generally. The average rate of pay for skilled machinists is £4, 9s, 1d (about $18) a week. The effect of the employers' proposals would reduce the present average wage to £3, 13s. 3d (about $15) a week. At the same time definite moves in wage reduction have taken place, and in the Birmingham locality men in skilled trades who were formerly receiving something over and above the base rates, plus the war extras, are now reduced to the regulation level. Further than this, discussion of the situation between individual firms and their employes has resulted in many cases in the latter foregoing bonuses.

In the engineering and allied industries the arrangements usually take the form of surrender of the last awards of 6s ($1.20) per week, and 15 per cent to piece-workers, which were granted for reasons unconnected with the cost of living, when trade was uncommonly prosperous last June. Alternatively, the awards of 12 per cent and 7½ per cent made by Mr. Churchill during his tenure of office have been given up in certain cases. Union difficulties, however, are operating in some cases against the voluntary relinquishing of bonuses. For example, the well-known Daimler Co., of Coventry, made a definite offer to its employes, that if they would accept a reduction in bonus, the district rate to remain the same as hitherto, the company would provide full-time employment on a new car which it was desirous of placing on the market. A large body of workers were in favor of accepting this offer, but the Union objected, which resulted in a shut-down.

Prices of Materials

Prices of materials continue to fall, and steel bars have now reached £15, 10s ($62) to £16, 10s ($66) per ton, though imported Belgian bars, which are apparently of a somewhat inferior quality, have maintained their margin and are now selling at £8, 10s ($34) per ton. Considered as a whole, the prices of iron and steel had by the end of last month fallen 28 per cent since the same date twelve months ago, but by far the greater part of the fall has occurred in the last four months. Although having little direct effect on the prices of machine tools, these falling prices are significant of the general fall in the price of commodities, which eventually is likely to cause a general lowering of wages that now remain the only excuse for the maintenance of high prices for goods representing a high labor percentage of value.

NEW MACHINERY AND TOOLS

THE COMPLETE MONTHLY RECORD OF NEW AMERICAN METAL-WORKING MACHINERY

The New Tool Descriptions in MACHINERY are restricted to the special field the journal covers—machine tools and accessories and other machine shop equipment. The editorial policy is to describe the machine or accessory so as to give the technical reader a definite idea of the design, construction, and function of the machine, of the mechanical principles involved, and of its application.

Anderson Automatic Nut Tapping Machine

The Anderson Die Machine Co., Iranistan Ave., near Admiral St., Bridgeport, Conn., has recently developed a double-spindle automatic nut tapping machine, which is adapted for the performance of a wide range of work. It represents a radical departure in designing the reversing type of tapping machine in that no clutches are employed for the purpose of reversing the spindles for the performance of the threading operation and for the backing out of the tap. Instead of clutches, the spindles are positively driven in either direction by means of a gear segment meshing into a train of gears, this segment being oscillated back and forth through the medium of crank motion. The throw of the crank is adjustable to give any desired number of revolutions to the tapping spindles in either direction, within the capacity of the gear train and the length of segment, which, in this machine, is fifteen revolutions of the tap in either direction. This, on a 32-pitch tap, would give at least ten complete threads in the piece to be tapped, or through a thickness of 5/16 inch, although the machine is built and intended for use on work not exceeding 3/16 inch in thickness.

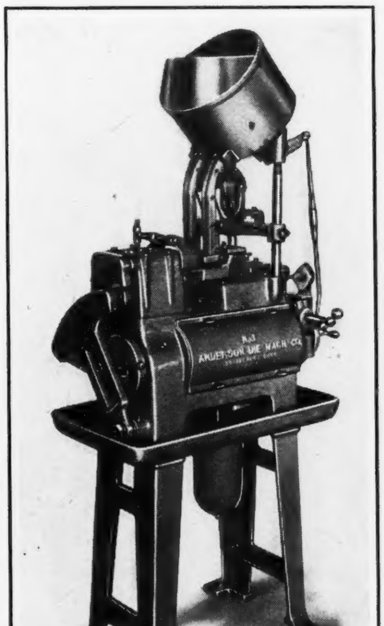


Fig. 1. Front View of Double-spindle Automatic Nut Tapping Machine built by the Anderson Die Machine Co.

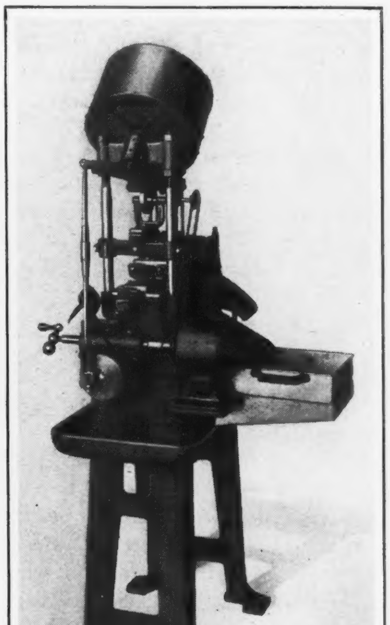


Fig. 2. Rear View of Double-spindle Automatic Nut Tapping Machine built by the Anderson Die Machine Co.

Of course it is understood that the crank motion which controls the oscillation of the gear segment should never be any greater than is actually necessary for the complete tapping of the nut. The crank disk is mounted on the end of a horizontal shaft running throughout the entire length of the machine frame. This shaft is driven by means of a worm-gear enclosed in an oil-tight case, the worm being driven by a constant-speed motor, either direct or alternating current, at a speed of 1750 revolutions per minute. The worm and worm-wheel are of such a ratio as to give approximately 56 revolutions per minute of the horizontal shaft, and the crank is so arranged that the spindles will complete 56 cycles per minute. As there are two work-spindles, it will be seen that this gives a total of 112 pieces tapped per minute. In machines intended for tapping very small nuts, say up to No. 6–32 in brass, a worm and worm-wheel can be furnished which

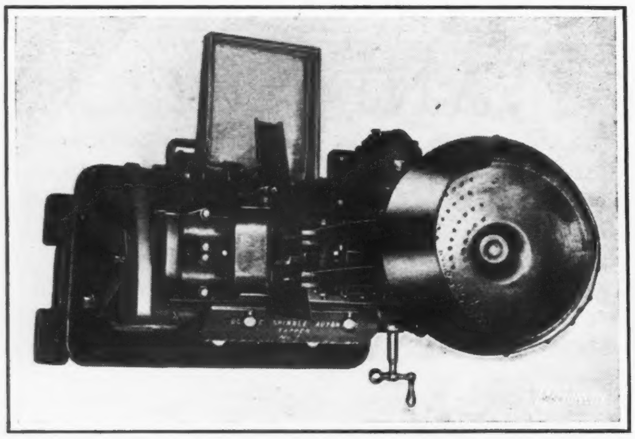


Fig. 3. Top View of Anderson Tapping Machine, showing the General Arrangement of the Mechanism

will give 68 cycles per minute, or a production of 136 tapped pieces of work from the two spindles.

The horizontal shaft carries the cams necessary for operating the feeding mechanism. These cams are adjustable so that the machine can be timed very accurately, and inasmuch as the shaft which carries the cam also has the crank disk secured thereto, it follows that the timing of the various feeding elements with the direction of rotation of the spindle will remain accurate. A hopper is provided which will readily feed either hexagonal or square nuts, and chutes carry the work from this hopper into the tapping position.

Push-rods carry the nuts from the feeding positions in the chutes into engagement with the taps. The construction of the chutes is such that the nuts never leave the chutes until they are completely tapped. This eliminates any possibility of the nuts sticking, due to obstructions which might occur in transferring them from the chutes into some other holding elements. The hopper has an agitator in the form of a disk which oscillates through a crank motion that is also mounted on the horizontal shaft to which previous mention has been made. A vibrator is provided on the machine that will prevent the parts or nuts from sticking in the chutes during their transfer; and an oil pump, reservoir, and complete lubricating devices are built into the machine. The spindles are made of high-carbon steel and mounted on ball bearings where their speed warrants the use of such a construction. The horizontal shaft has plain bearings, which are of ample length to assure long life.

This machine will tap either square or hexagonal nuts ranging in size from 3/16 to 5/8 inch across the flats from 1/16 to 3/16 inch in thickness, from the smallest diameter tap up to No. 10–24, without providing special chutes and at the rate of 112 per minute. No special taps are required. The only necessary change is in the making of two small blocks that form the entrance for the nuts into the chutes, two push-rods made of 5/8-inch square cold-rolled steel, approximately 4 inches long, and two fingers that hold the nut while it is being transferred from the feeding position of the chute into engagement with the tap.

In a great many cases, the push-rods or the fingers need not be changed. This all depends upon the size of the tap being used and the dimension across the flats, so that the fingers will cover a wide range of work. The small blocks referred to, which form the entrance of the chute, will serve for either square or hexagonal nuts of the same dimension across the flat and of the same thickness. Such parts as may be necessary to tap the nuts of various sizes can be furnished as special equipment. From the foregoing it is evident that the machine as designed will cover a wide range of work without making special feeding devices. Adjustments are provided for taking care of practically all conditions that might arise.

CARLTON RADIAL DRILLING MACHINE

A line of heavy-duty radial drilling machines is being built in 2-, 2½-, 3-, 3½-, 4-, 5-, 6-, and 7-foot sizes by the Carlton Machine Tool Co., 2994 Spring Grove Ave., Cincinnati, Ohio. All sizes are of the same design, and among the principal features it may be mentioned that ball bearings are used throughout, and that the control levers governing the feed, speed, and locking mechanisms are conveniently placed and interlocking so that they are foolproof. The machines are designed and built on the unit principle, and each unit is equipped with a sight or oil-level gage, in order that the operator may tell at a glance whether or not the machine is being sufficiently oiled.

Any of the following drives may be furnished on these machines: Cone pulley, tight and loose pulley through a gear-box, constant-speed motor through a gear-box, or variable-speed motor driving directly without a gear-box. Ordinarily, these drives are mounted on the base as shown in Fig. 1, which illustrates a constant-speed motor driving through a gear-box, but either of the motor drives mentioned may also be placed upon a rear extension of the arm as shown in Fig. 2, which also shows a constant-speed motor used in connection with a gear-box. In drives employing a gear-box, six speed changes are obtainable, and these may be secured while the machine is running, by operating the lever on the front end of the speed-change shaft, either by hand or foot. There are two columns on the machine, the outer one being of large diameter and machined from a semi-steel casting finished by grinding. All drives mounted on the base of the machine are connected by a coupling to a unit containing bevel gears which transmit power to a vertical shaft at the center of the columns. This shaft, in turn, transmits power through three gears to the vertical shaft on the outer column. The outer vertical shaft drives, through bevel gears, a horizontal shaft which conveys power to the spindle head.

The arm elevating screw is stationary, the arm being raised and lowered by means of a revolving nut. The arm may be clamped to the column by two eccentric levers, and when this has been done, it cannot be raised or lowered until both of the levers have been released. These levers cannot become engaged while the arm is in motion. When the arm is raised to the top of the column, it is stopped automatically through a plunger disengaging the elevating mechanism, and if the arm or head meets any obstruction while being lowered, it is also stopped automatically.

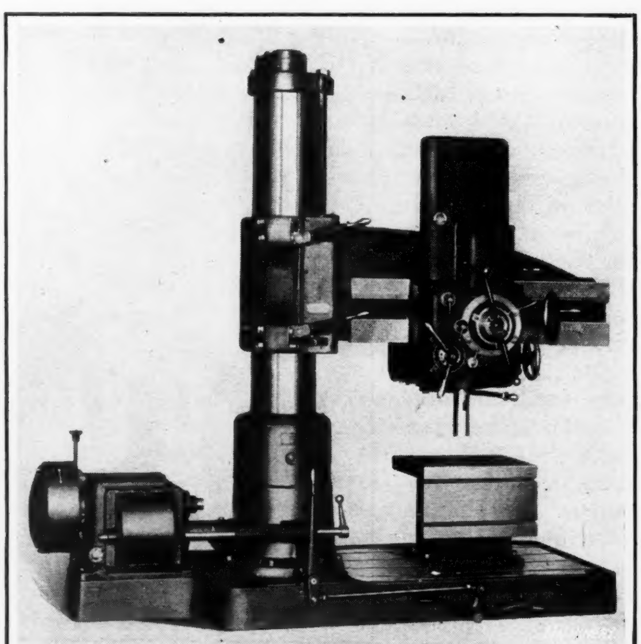


Fig. 1. Front View of 4-foot Carlton Radial Drilling Machine with Belted Motor Drive through Gear-box

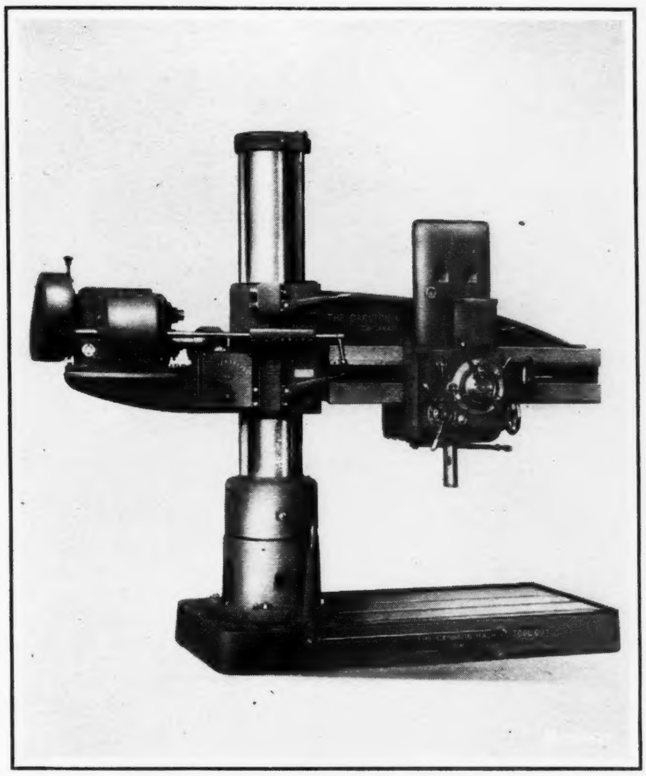


Fig. 2. Carlton 5-foot Radial Drilling Machine with Belted Motor Drive through Gear-box on Arm

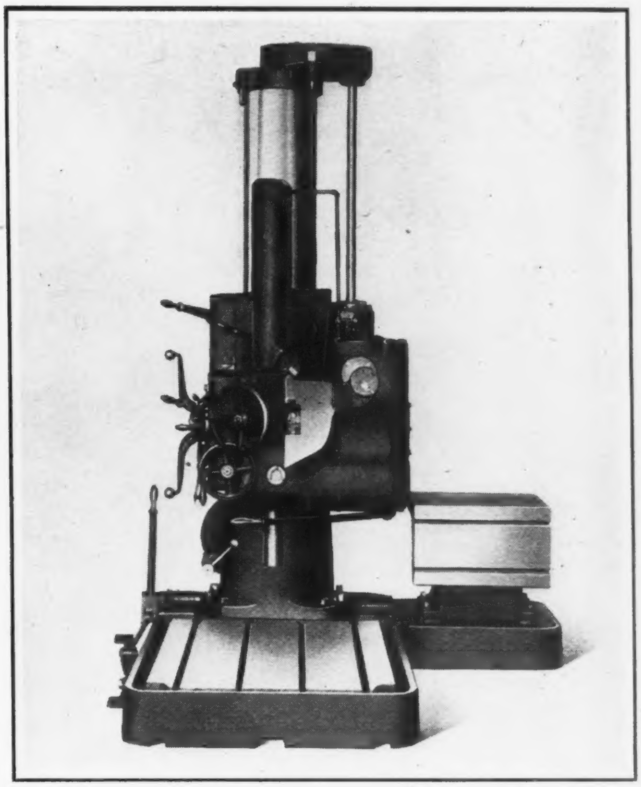


Fig. 3. Carlton 4-foot Radial Drilling Machine, showing Plain Box Table, and Table Wing on Base

The outer column revolves on ball and roller bearings on the inner one, this arrangement permitting the arm to be swung around with little effort. When this movement is too free, the condition may be remedied by adjusting a brake on the column. Neither the inner nor the outer column is split. The outer column is locked to the inner one or unlocked by operating either the hand-lever or the foot-treadle at the front of the base, as seen in Figs. 1 and 2. The base has a large working surface and is provided with pockets on each side of the column, which are connected to an oil-channel that passes completely around the base. From these pockets the oil is returned to a reservoir. A pump is mounted on the top of the reservoir at the back of the column.

As previously mentioned, a horizontal shaft delivers power to the transmission at the rear of the head. There are four speed changes in this transmission which, together with the six speed changes obtained by means of the gear-box, give twenty-four speeds to the spindle in geometrical progression, covering a range of from 18 to 800 revolutions per minute. All gears in the transmission are chrome-nickel steel, hardened and mounted on shafts supported at each end by ball bearings. The transmission case holds ten gallons of oil, and contains a pump for flooding oil to the

Fig. 4. Universal Table for Carlton Radial Drilling Machine, with a Round Table mounted on it

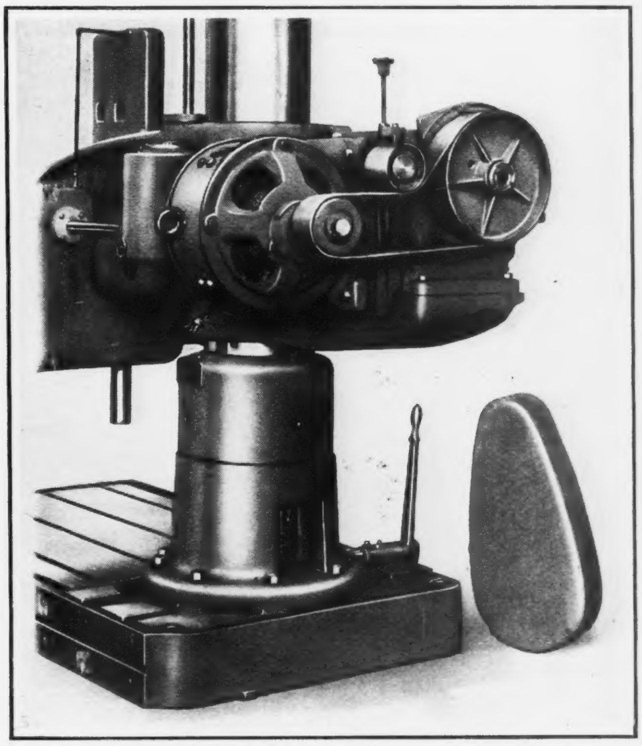


Fig. 5. Belted Motor Drive through Gear-box on Arm, with Cover removed to show Belt Tensioning Device

bearings and gears at all times. Twelve spindle speeds covering a range of from 0.005 to 0.069 inch per revolution can be obtained by operating small levers at the front of the head. The head is made up of sub-units which are entirely enclosed, and it can be pushed or pulled the entire length of the arm by hand. The arm is furnished with long flat ways to accommodate the head.

The spindle drive is placed as close as possible to the lower end and on the largest diameter of the spindle. The latter is provided with a hardened renewable tang socket. The sleeve for raising and lowering the spindle is mounted near the top, and the spindle is balanced by a counterweight that acts through the same pinion that operates the rack for raising and lowering the spindle. Thus, when the spindle is lowered, the weight is raised, and vice versa. The spindle is stopped automatically when it has been raised or lowered through its maximum movement. A dial on the front of the head may be set to stop the travel of the spindle when any desired depth of hole has been obtained.

The base extension shown in Fig. 3 can be attached to the base at any time this is necessary. The extension, as well as the universal table shown in Fig. 4, are furnished as separate equipment. When a constant-speed motor is used in conjunction with the gear-box, a belted motor drive is recommended as shown in Fig. 5, in which the motor is mounted on the arm. The same drive is used when the motor is placed on the baseplate. Through an idler pulley arranged as shown, it is possible to obtain enough belt contact on both the driving and driven pulleys to assure obtaining an efficient drive.

H & G THREADING MACHINES

Two new threading machines have been brought out by the Eastern Machine Screw Corporation, 23-43 Barclay St., New Haven, Conn. The features of these machines include the application of hardened and ground spindles, and round tool-steel ways with bronze bearings that are easily replaced if it should ever become necessary. The design of the slides is such that the piece to be threaded is held low and near the slide bearing. This is said to do away with all cross strain and cramp, and to make perfect alignment possible under all conditions. Although designed with liberal margins of safety, the machines will be found to be relatively small and compact for their range of work and the rate of production which they are capable of attaining.

Fig. 1. Model SS Threading Machine built by the Eastern Machine Screw Corporation

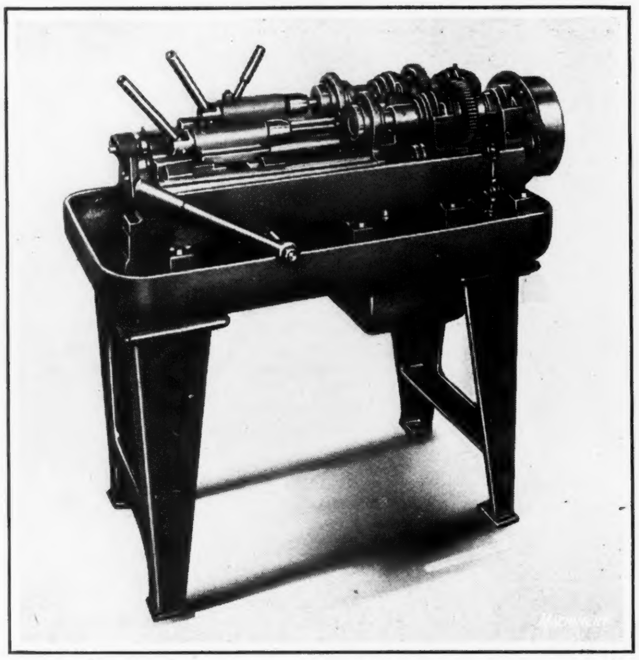


Fig. 2. Model DS Threading Machine built by the Eastern Machine Screw Corporation

Single-spindle H & G Threading Machine

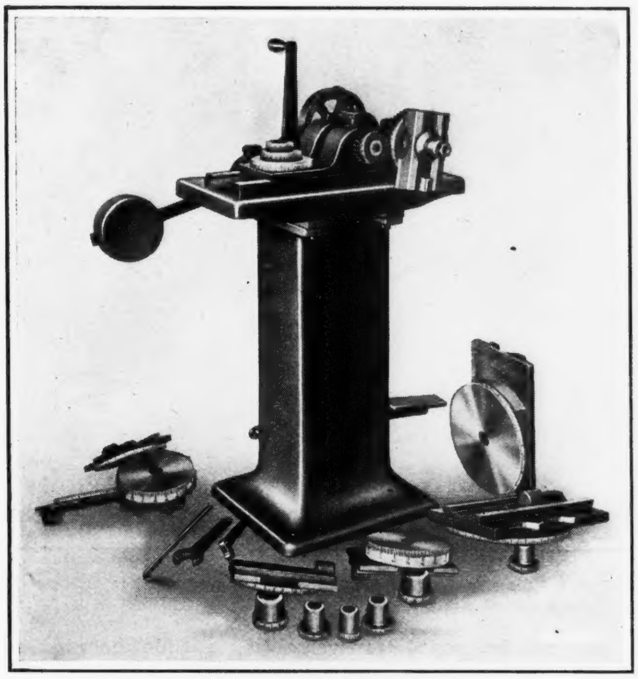
The small bench threading machine which has been on the market for a number of years has been recently redesigned for the purpose of improving its appearance and durability, and enlarging the range of work which it might be called upon to do. The new design is shown in Fig. 1, and it is known as a Model SS. This machine will be found useful in any shop where threading is done, especially for all sorts of second-operation work. It may be obtained as a bench machine or it may be equipped with a cabinet base, as desired.

While regularly equipped with spring collets, the slides may be furnished with an open-side jaw, when the shape of the work is such that this method of holding will be more desirable. An automatic stop provides for holding each piece of work at the same point, and an easily adjustable tripping arrangement insures having the proper length of thread cut on each piece. An interesting feature in connection with the open-side jaw is that the operator need use only one hand to close the jaws, feed forward the work, draw back the work, and open the jaws. All is done with one smooth action, leaving the other hand free at all times.

Equipped with a pump which may be instantly made to run right- or left-hand, the machine is capable of cutting either right- or left-hand threads, by simply changing chasers and reversing the belt. The hollow ground spindle permits threads to be cut up to 9¾ inches in length, whereas the open-side jaws provide for holding stock of any length required. Production with this machine should range from 300 to 1000 pieces per hour, depending upon the class of work, and it can be operated with practically unskilled labor. The machine is, of course, equipped with H & G dieheads; it will accommodate any size of head up to 1¼ inches capacity, and is designed to cut pitches as coarse as 11.

Double-spindle H & G Threading Machine

In response to a demand from many of its customers for a threading machine of greater capacity and maximum rate of production, the Eastern Machine Screw Corporation has brought out the double-spindle H & G threading machine illustrated in Fig. 2. The different gear ratios provided on this equipment make it possible to always operate at the most efficient speed, and with one operator handling two spindles, the cost of threading is reduced to a minimum. This is known as the Model DS threading machine.



Graduating and Marking Machine built by the Noble & Westbrook Mfg. Co.

NOBLE & WESTBROOK GRADUATING AND MARKING MACHINES

To provide for the performance of graduating operations, where accuracy of the product and speed of operation are required, the Noble & Westbrook Mfg. Co., Hartford, Conn., has recently placed on the market a machine which is shown in the accompanying illustration. Hand and power machines are furnished. On the power-driven machine, the loading of pieces of work on the machine and removing them when the operation has been performed are the only duties required by the operator. With the hand machine, one turn of the handle completes the work. Provision is made for holding the work in the proper relation to the graduating die, and the depth of the marking is governed by means of a foot-lever, cam, and weight, which are governed by a positive stop that is adjustable to provide for making any desired depth of lines. This insures making even and accurate impressions. The machine is equipped with steel spindles, adjustable bearings, and is fully automatic in operation, being stopped by means of a clutch on the spindle which drives the marking die. An idea of the range of work for which the machine is adapted will be gathered by referring to the pieces that are illustrated. Parts of various diameters can be graduated by changing the position of the intermediate gear located on the adjustable sector. Practically all types of modern machine tools are equipped with micrometer adjustments, and this machine is well adapted for the graduation of the dials used on micrometer adjusting screws; it is also adapted for graduating and numbering cross-slides and compound rests for lathes. The graduating and numbering are completed in one operation. The Noble & Westbrook Mfg. Co. also furnishes the full equipment for these machines, including the engraved steel marking dies.

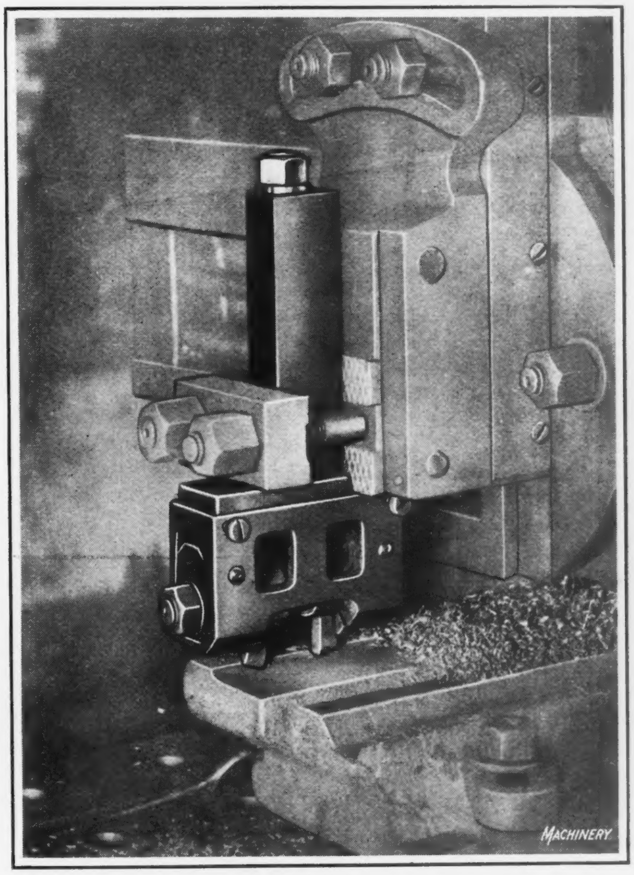
DUSENBURY DUPLEX PLANING TOOL

A tool known as the Dusenbury duplex planing tool is a recent product of the Waltham Machine Works, Waltham, Mass. It consists principally of a shank that is held in the regular manner. The planer clapper is fastened down, usually with a tapered pin. The tool-head contains two opposed clapper-boxes that operate the same as a planer clapper. The head can be swiveled, and in it there are held two high-speed tool bits. With this construction a chip can be cut, not only during the regular cutting stroke of a planer, but also with equal efficiency during the return stroke, thus taking advantage of the ordinarily idle stroke of the machine. This reduces by one-third to one-half the time required to plane a given piece of work. The tool is used to equal advantage on various operations of metal planing on horizontal, vertical, or inclined surfaces, and also in slots and dovetailed bearings. The positions of the tool bits are such that the result is the same as that obtained when using an underhung tool. This planing tool is strongly and simply constructed. All surfaces which are subject to wear are hardened.

The swiveling feature of this tool is a very important point, as it works to advantage on every operation on which the tool is applied. This motion swings the tool-head so that one tool stands ahead of the other, and with the adjusting screws which bear against the graduated foot of the tool shank, any desired cut or position is easily obtained.

Horizontal surfaces may be planed by the Dusenbury duplex planing tool in about one-half the usual time, by doubling the customary feed of the planer. The tool shank is clamped vertically, the same as any tool-holder. The tool-head, containing the two tools, is swung one or more degrees to suit the feed set for the planer, so that the two tools cut an equal amount, or the tool-head may be swung over and then the feed of the planer can easily be adjusted to correspond.

Vertical or inclined surfaces can also be planed in about one-half of the usual time, by using this duplex planing tool which is placed in position with the shank straight with the planer clapper-box that is thrown over away from the work. The tool-head is swiveled one or more degrees to suit the amount of chip desired. The tools are placed in the angle slots of the clappers at about 45 degrees, until the ends rest against the surface to be planed, and then they are tightened. This will bring one tool higher than the other. Then the feed is increased until each tool cuts an equal amount. Having planed one side of the work, move the planer clapper-box over and swing the tool-head one-half turn, and the tools will be set for planing the other side.



Dusenbury Duplex Planing Tool made by the Waltham Machine Works

Slotting operations can also be done in about one-half the usual time. When using tools that are of the same width as the slot to be made, one tool is set higher than the other by the amount desired for the chip. The planer feed is increased so that both tools will cut the same amount. When cutting slots with tools that are narrower than the slot which is required, the tools are set the same height and the tool-head is swiveled through the desired amount by the adjusting screws, so that one tool will cut one side of the slot and the other will cut the other side, making the slot the desired width with one down feed of the slide.

The same increased production can be obtained on dovetail planing by using the duplex planing tool as is possible in the other planing operations. By setting one tool higher than the other and feeding double the usual amount, after planing one side, swing the tool-head one-half turn, after making the usual planer changes, and the tools will be set for planing the other side.

POWERS DUPLICATE-DRILLING MACHINE

The duplicate drilling of a small number of parts, so as to make them interchangeable, is generally accomplished with difficulty, due to the fact that the expense of a special jig or fixture for the job is unwarranted. To facilitate such work, the Sterling Tool & Machine Works, Inc., 205-209 W. 19th St., New York City, are placing on the market the duplicating machine shown in the accompanying illustrations. This machine is so designed that after one part has been drilled, it can be clamped to the right-hand side of the table and used as a model for drilling the remaining unfinished parts, means being provided for shifting the spindle and locating it properly for the drilling of each hole on an unfinished piece. This machine may also be used for the performance of spot-facing, reaming, and milling operations.

An arm *A* extends forward from a bracket integral with the side of the column. This arm at the outer end supports a vertical center *B*. The distance from the face of the column to the center of the spindle is identical with the distance from the face of the column to the center of center *B*, and as arm *A* is stationary on the column the same relation between the spindle and center *B* is always maintained. The

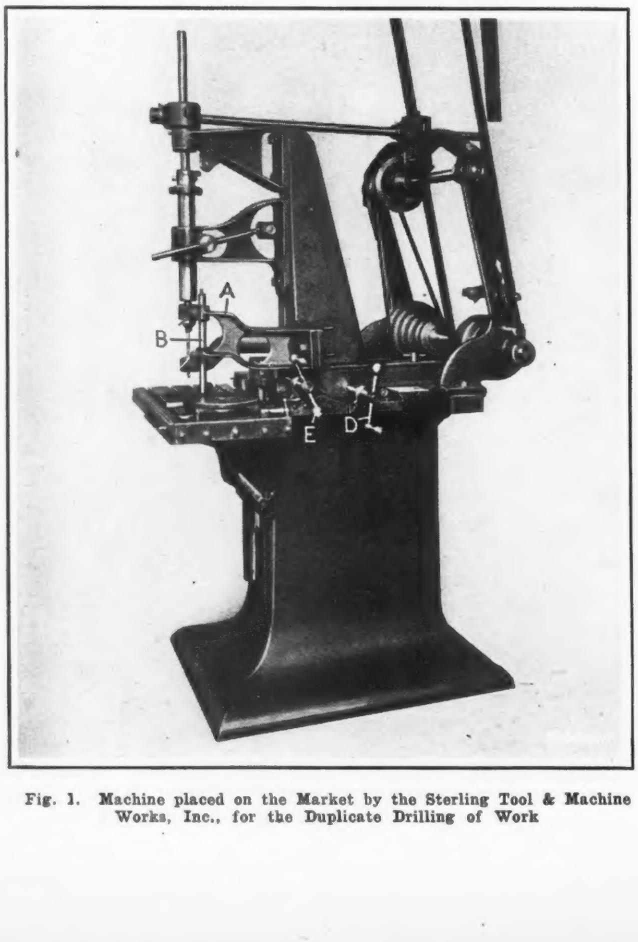


Fig. 1. Machine placed on the Market by the Sterling Tool & Machine Works, Inc., for the Duplicate Drilling of Work

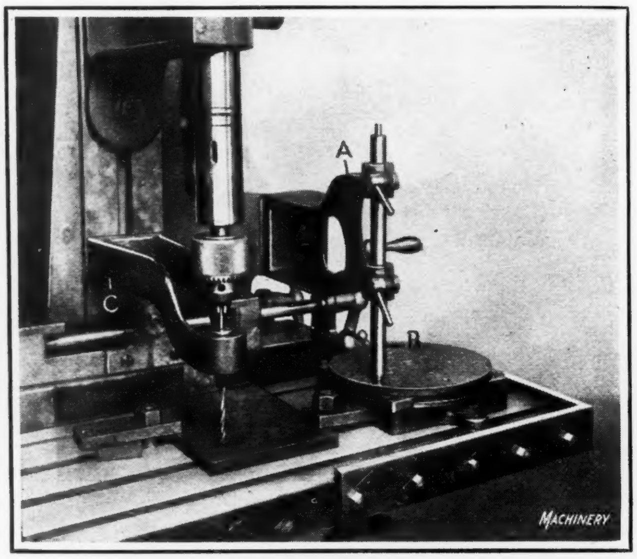


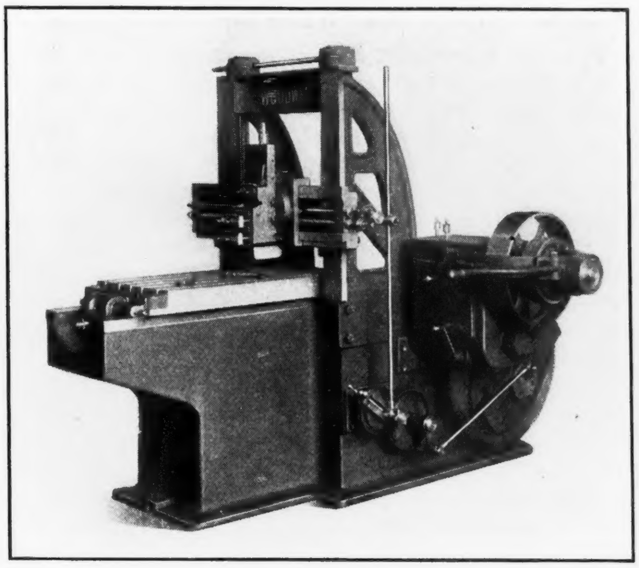
Fig. 2. Close-up View of the Device provided to assist in locating the Spindle over the Work

column can be moved transversely on a slide mounted on the base, and this slide has a lateral movement. By these means, when a finished part is clamped on the table beneath center *B* and an unfinished part is bolted in a like position beneath the spindle, if the column and slide are shifted until the center can be inserted into a drilled hole on the finished part, the unfinished part will be properly located for the drilling of the corresponding hole.

After the latter has been done, the column and slide are moved to permit the placing of center *B* in a second hole, the spindle being, of course, at the same time similarly shifted over the unfinished part. This method of drilling from a finished part enables a repair part to be machined correctly when the original part has become broken or worn. It is not necessary, however, to drill from a previously machined part, as center *B* can also be set to the intersections of lay-out lines. On very accurate work, toolmakers' buttons can be screwed on the table and used for locating purposes. Center *B* is then reversed, the end shown at the top in the illustrations being suitable for fitting over the buttons. The drill is guided through a bushing in arm *C*, and a number of bushings are supplied to suit various sizes of drills. A special wrench is furnished to facilitate the removal of these bushings from the arm.

The lateral movements of the column slide are obtained through the rotation of crank *D*, Fig. 1, on the right-hand side of the machine, while the transverse movements of the column on the slide are obtained by rotating crank *E*. The latter is mounted on a shaft which drives the adjusting screw of the column through helical gears. Graduated dials on the crank-handles permit settings of 0.001 inch to be obtained. The spindle is hand-fed through a rack and pinion, and a stop collar is provided for drilling to depth. The arm which guides the spindle rack may be adjusted vertically to suit the length of the drill being used.

The table is adjusted vertically through a rack and pinion mechanism, and is provided on the upper surface with five T-slots. The machine is designed for being driven from a lineshaft, the countershaft being mounted on a frame bracketed to the rear of the base. A mechanical belt shifter is provided for changing the driving belt from the loose to the tight pulley and vice versa. This shifter is so designed that the belt cannot move across the pulley faces of its own accord. The cone pulleys, with which the machine is equipped, permit the use of five spindle speeds. The drive from the upper cone-pulley shaft to the spindle is through a set of bevel gears, a short vertical shaft, two sets of helical gears, and a long, sliding, horizontal shaft. This equipment was invented by James Powers and is known as the Powers duplicate-drilling machine.



Crank Planer lately developed by the Woodward & Powell Planer Co.

WOODWARD & POWELL CRANK PLANER

The Woodward & Powell Planer Co., 97-99 Webster St., Worcester, Mass., has recently developed a 24- by 24- by 24-inch crank planer which is particularly adapted to such forge and railroad shop work as the machining of die-blocks, rod straps, gibs, shoes, wedges, cross-heads, etc. From the illustration it will be seen that the bed, housings and cross-rail are massively constructed, so as to furnish ample rigidity. The table has large bearing surfaces on the bed, and is gibbed its entire length. The length of stroke is adjustable up to 24½ inches. The table is 40 inches long, or 15½ inches longer than the maximum stroke; however, the table can be adjusted along the bed so that a piece of work placed anywhere on the table, can be brought past the head. The latter can be swiveled to either side for angular planing, and is graduated in degrees.

The cross-rail gibs are secured by nuts on studs threaded into the cross-rail, and the cross-rail screw and rod are squared at both the front and rear ends to suit a crank. The feeds for cross, vertical, and angular traverses of the head are operated automatically by power or by hand, and take place on the return stroke, so that a longer stroke than necessary for a cut is not required. The planer can be driven by a single pulley, connected to a four-speed gear-box, by a motor mounted on the top of the gear-box and directly connected to it by gears, or by a four-step cone pulley without a gear-box. The handle for operating the starting and stopping clutch of a planer driven through a gear-box also operates a brake for stopping the table when the clutch is thrown out.

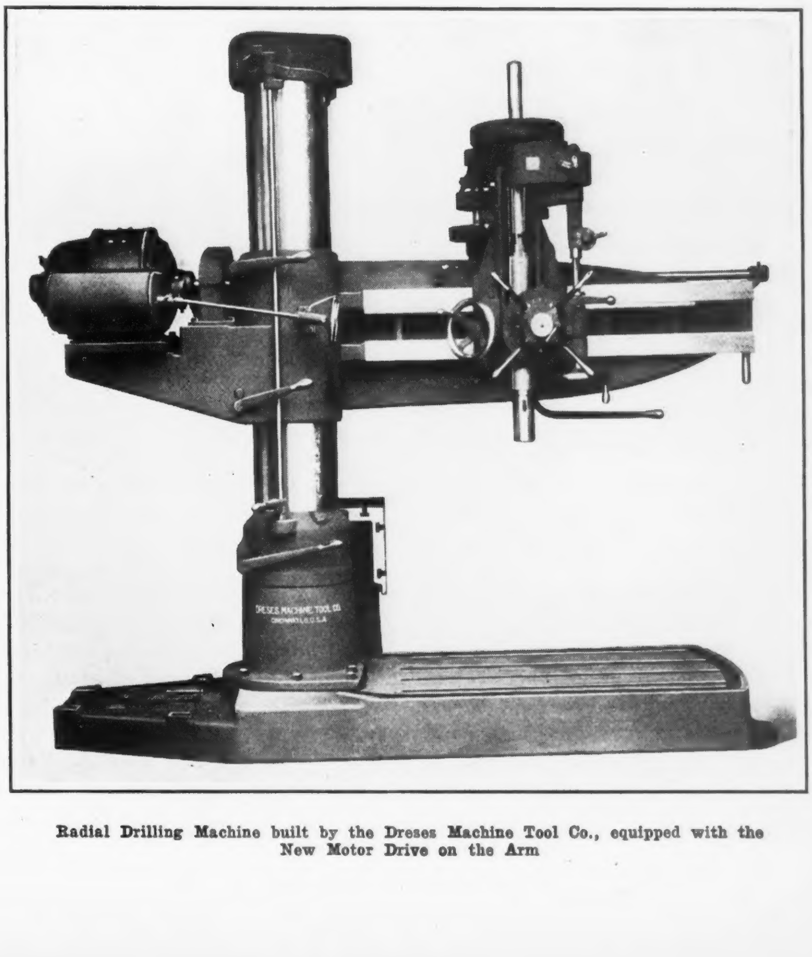
All gears and revolving parts are thoroughly guarded; these guards were removed from the machine at the time the photograph was taken, in order that the working parts might be shown to better advantage. Some of the specifications of the planer are as follows: Stroke, from 0 to 24½ inches; height between table and cross-rail, 25 inches; width between housings, 25 inches; working surface of table, 40 by 21 inches; table strokes per minute by means of cone pulley or gear-box, 10, 17, 29, and 48; approximate weight of the machine, 8000 pounds; and horsepower of motor required, when motor drive is employed, 5.

DRESES MOTOR DRIVE ON RADIAL DRILLING MACHINE ARM

About sixteen years ago, a radial drilling machine provided with motor drive on the arm was brought out in England. The first arrangements were rather crude and complicated, and some makers in England, and subsequently in this country, used two motors—one for driving, and the other for elevating the arm. The disadvantage of the dangling connecting wires, the swinging of the heavy motor and driving mechanism, the complicated provision for operating the controller, and the adaptability for direct-current or variable-speed motors only, retarded the general adoption of such an arrangement in this country. With the advent of high-speed drills, the simplification of the driving mechanism became of great importance, and this changed the view of users; therefore this type of drive has gained much in favor in recent years.

In the arrangement here illustrated on a 5-foot radial drilling machine, the simplification is carried out to what the builders of this machine believe to be the last detail. The pinion on the motor meshes directly with a large gear on the horizontal back-shaft of the arm. It thus eliminates two pairs of bevel gears, three spur gears, eight bearings, and two long and one short shaft in the driving mechanism. This reduces the total friction by about one-half, so that a motor can be used which is of one-third less capacity than the size required when the motor is placed on the base of the machine.

It will be noticed that the controller is mounted in front of the motor, and by means of a universal joint, shaft, and bracket, the controlling handwheel is brought within easy reach of the operator. The handwheel rim is beveled at an angle of 45 degrees and indexed, giving the spindle revolutions at the different stations of the controller. A fixed pointer, reaching over the handwheel, serves as an indicator. By this arrangement, four sprocket wheels with chains, several brackets with bearings, two bevel gears, and a long shaft are eliminated, all of which are necessary when the



Radial Drilling Machine built by the Dreses Machine Tool Co., equipped with the New Motor Drive on the Arm

controller is placed at the rear of the motor and arm. The motor is placed on a sub-base, so that any type can be used without making a change in the arm. This form of motor drive has lately been applied to radial drilling machines built by the Dreses Machine Tool Co., 227-239 W. McMicken Ave., Cincinnati, Ohio.

CINCINNATI HIGH-SPEED DRILLING MACHINE

The Cincinnati Hy-Speed Machine Co., Cincinnati, Ohio, has developed the drilling machine shown in the accompanying illustrations, which has several unique features. It is driven by a single pulley connected to the cone pulley shaft at the rear and top of the machine. The second cone pulley is mounted directly on the upper end of the drill spindle. An idler pulley is provided for the cone pulley belt on the right-hand side of the machine. This idler is mounted on the belt-shifter, and assists in leading the belt from one step of the cone pulleys to another. The machine is quickly stopped or started by means of the handle that projects toward the front from the left-hand side of the column.

The table-elevating mechanism is placed sufficiently back of the spindle so that arrangements can be made to allow the passing of taps through the table. This feature, together with the use of a quick-release chuck, enables tapping operations to be accomplished at high speeds and without necessitating a reversal of the direction of the tap rotation. The various spindle speeds are controlled by the handle on the right-hand side of the column. The clutch is of the dry-plate type, and is operated in connection with an air-cooled brake. All pulleys on the machine are made of aluminum. A power feed and an automatic tapping attachment can be furnished if desired, and an oil pump and tank can also be supplied as separate equipment to be attached to the base. In addition to the type illustrated, this machine is built in bench, single-speed, and motor-driven types.

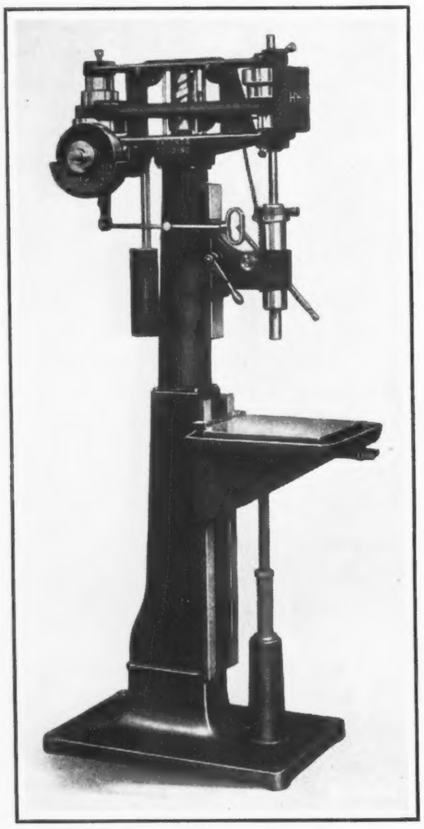


Fig. 1. Drilling Machine developed by the Cincinnati Hy-speed Machine Co.

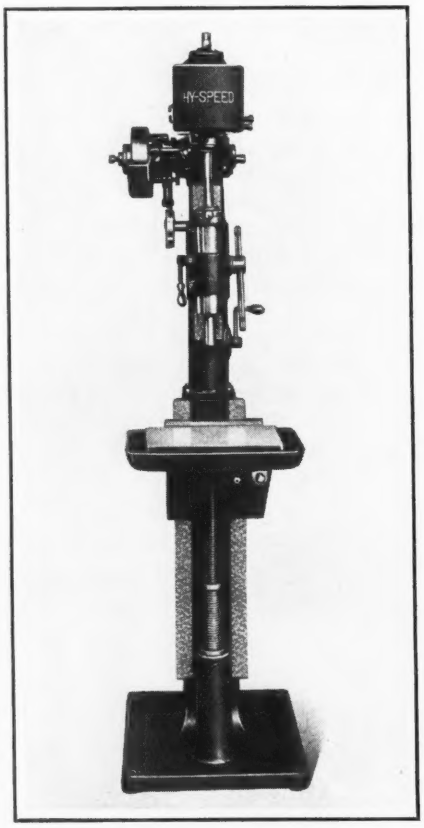


Fig. 2. Front View of High-speed Drilling Machine shown in Fig. 1

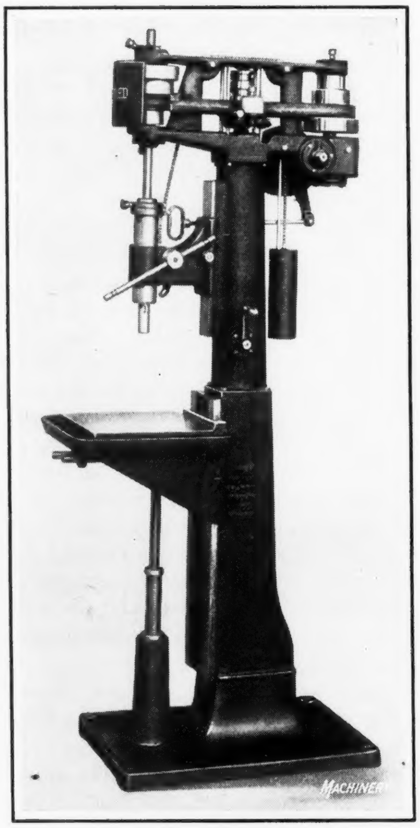


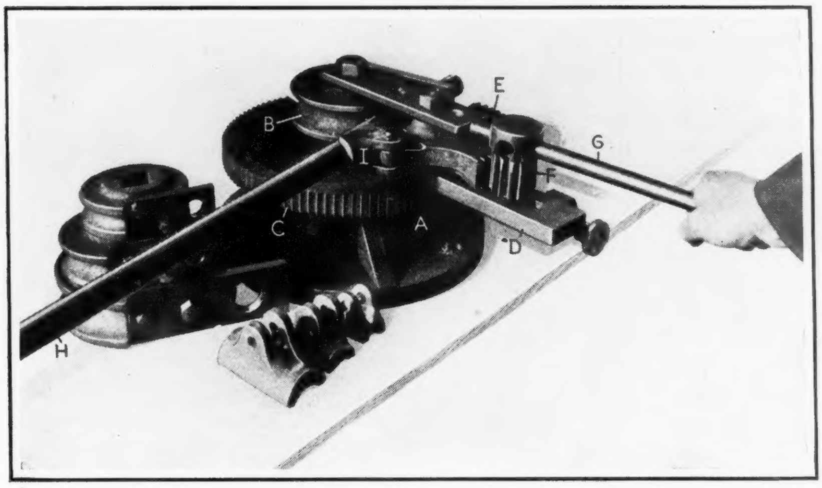
Fig. 3. Right-hand Side of Machine, showing Idler Pulley and Speed-control Handle

LEONARD PIPE-BENDING MACHINE

The Leonard Machine Works, 1023-1027 Race St., Philadelphia, Pa., has recently placed on the market, a pipe-bending machine which is made in three sizes, Nos. 1, 2, and 3. The No. 1 machine bends pipe from 0 to 1 inch; the No. 2, from 1 to 2 inches; and the No. 3, from 2 to 4 inches. A No. 1 machine is shown mounted on a bench. This size may be furnished with or without a floor pedestal, while the Nos. 2 and 3 sizes are furnished with the floor pedestal as a regular equipment. Each machine is equipped with four forming heads and four bending shoes, which accommodates the regular run of pipe bending. For handling unusual work, special shoes may be furnished.

The machine consists of a cast-iron base *A* carrying a large upright center stud, the upper part of which is square to fit a hole of the same shape in the forming head *B*, thus preventing its rotation. This stud is a light driving fit in the base, and is held against movement by two large setscrews on top of the base. Secured by the stud, there is a cast-steel ratchet segment *C*, and above this ratchet is a cast-steel arm *D*, on the lower part of which is a plunger-pin engaging the teeth on the ratchet wheel. This cast-steel arm has several tapped holes into which the center studs for the shoe-carrying gear segment lever *E* and pinion *F* are mounted. The pinion is made of steel and casehardened, and it has two large holes on top that are drilled at right angles to each other, into which the hand-lever *G* is inserted when operating the machine.

In operation, the workman slips the straight pipe *H* through a hole in the guard that protrudes from the forming head; then he rotates the pinion *F* until the swiveling shoe *I* contacts with the pipe. Further movement of the hand-lever causes the pipe to bend uniformly around the forming head *B*, and as the bending progresses it is necessary to move the cast-steel arm *D* further around the circle, which is done by the spring-pin engaging the ratchet *C* further around the circle. This process is repeated until the bending is completed. Pipe may easily be bent cold and unfilled. This machine is of special use to plumbers,

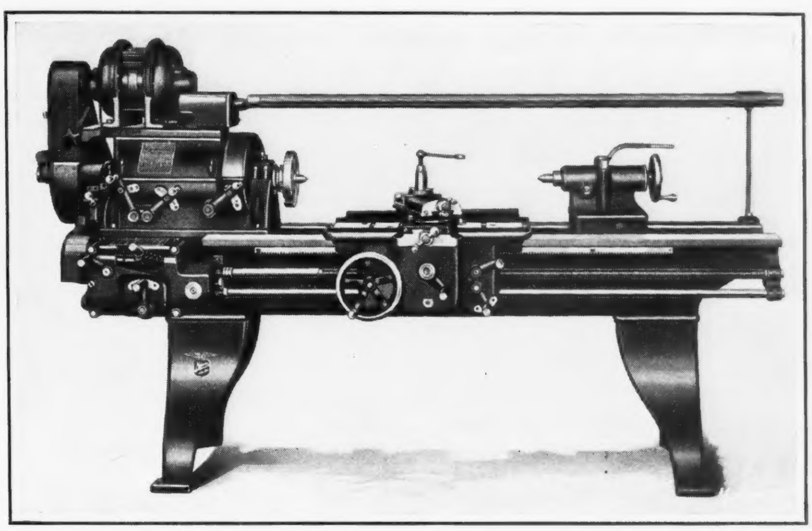


Pipe-bending Machine built by the Leonard Machine Works

electricians, and general machine shops, or wherever pipe-bending is done. The No. 1 machine is portable and may be taken to the work. Its weight is 95 pounds when equipped for bending; but complete with all four forming heads, it weighs approximately 115 pounds.

MORRIS GEARED-HEAD LATHE

The Morris Machine Tool Co., Cincinnati, Ohio, has recently added to its line a single-pulley-driven geared-head lathe which is built in 16-, 18-, and 22-inch swings. The geared head provides twelve spindle speeds, and with a double friction countershaft, twenty-four speeds or twelve forward and twelve reverse are obtainable. All the gears are steel, heat-treated and hardened. The headstock is filled with oil up to a certain level, permitting the gears to dip in enough so that they will be thoroughly lubricated.



Geared-head Lathe built in 16-, 18- and 22-inch Swings by the Morris Machine Tool Co.

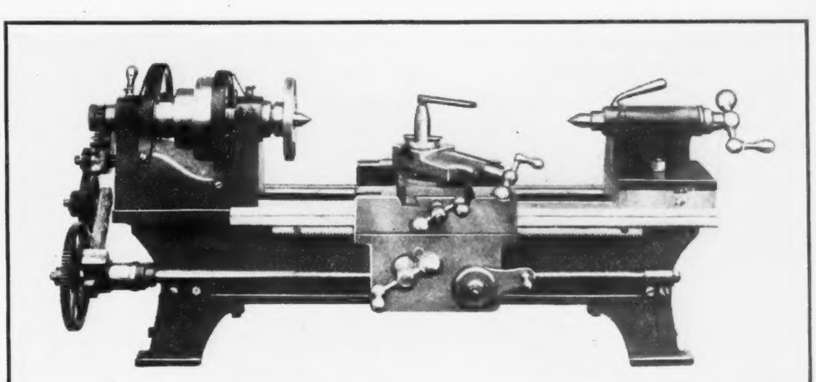
All speeds are secured through sliding gears and one positive back-gear clutch, friction clutches or any parts requiring adjustment having been eliminated. The only friction clutch is in the pulley at the initial drive, which is of a large diameter and is controlled by a shifter rod running the full length of the lathe. This permits the operator to start and stop the lathe from any working position. Speed changes are secured through the levers in front of the head. The two levers at the back end control a set of sliding gears, giving six speeds. The lever at the front end operates the back-gears and clutch. This lever, when engaging the direct-drive clutch, slides the back-gear pinion out of mesh, preventing the back-gears from running idle at high speed and from absorbing unnecessary power when releasing the friction clutch in the pulley. A brake can be applied by the same pull which stops the idle rotation of the spindle. This is a great convenience, both when shifting gears and when turning the work partly around for inspection at different points on the diameter. The pulley is protected by a guard which can be swiveled to suit the angle of the belt.

The Morris geared head is interchangeable with the cone head. All geared heads are arranged to receive the motor drive unit at any time. The motor is mounted on a plate, bolted to the head, and drives the clutch pulley by an endless belt which is furnished with the motor drive details. An idler pulley adjusts the tension of the belt by means of the star handle at the front of the motor plate. The idler pulley and bracket are mounted on the motor plate, making the motor drive unit self-contained. On the 16-inch lathe, the available range of spindle speeds is from 12 to 347 revolutions per minute, and on the 18- and 22-inch machines, the range is from 10 to 297 revolutions per minute. On all sizes of lathes, the speed changes are arranged in geometrical progression.

JOHNSTON ENGINE LATHE

The "Invincible" 9-inch swing, back-geared screw-cutting lathe shown in the accompanying illustration was designed by the Johnston Mfg. Co., 582 Elm St., Arlington, N. J., especially for use in garages, machine shops, and manual training schools requiring a small heavy-duty lathe of this type. It has been carefully designed for ease and convenience in operation. The bed is of heavy construction and is made to avoid chatter or vibration in taking a heavy cut. The actual swing of the machine is 9½ inches and the distance between centers is 17½ inches, the bed being 36 inches long.

The spindle is hardened and ground, and is made of high-grade steel. The hole is ¾ inch in diameter, and it extends the entire length of the spindle. The bearings in the headstock are lined with bronze. Like the head spindle, the tailstock spindle is made of high-grade steel. The tailstock is equipped with a taper-turning attachment which may be



Heavy-duty 9-inch Engine Lathe built by the Johnston Mfg. Co.

set over for turning tapered parts. The carriage is of rigid design, having a bearing of 9⅜ inches on the ways of the bed, and it is so constructed that when the slide-rest is removed, it leaves a perfectly level surface for clamping and boring purposes. T-slots are provided for use in connection with the performance of this class of work.

WALLACE BENDING MACHINES

In Fig. 1 is shown a No. 3 ring coiling machine, and in Fig. 2 a power-driven pipe-bending machine. These two equipments are recent products of the Wallace Supplies Mfg. Co., 412-420 Orleans St., Chicago, Ill. The machine shown in Fig. 1 is adapted for the manufacture of rings and coils of various diameters, and its rolls are removable so that the machine may be arranged to suit the form of material that is to be bent, namely, pipe, angle-iron, channels, tees, square bars, etc. Another application is in the production of spirals made of reinforcement rods, such as those used in reinforcing concrete columns.

As shown in Fig. 1, the machine is arranged for bending angle-irons, for which duty the machine can handle work having a diameter of 30 inches, and lighter sections may be formed to circles of smaller diameters. It is operated by a lever which engages friction clutch pulleys for furnishing the forward and reverse drives. Rollers can be furnished which are suitable for bending material of any shape or cross-section. The upper of the two rollers is adjustable by means of a hand-screw to provide for securing any diameter of coil that is desired. Standing in front of the machine is an angle-iron which was bent cold on a machine of this design. The machine occupies a floor space of 42 by 54 inches, and weighs 1200 pounds.

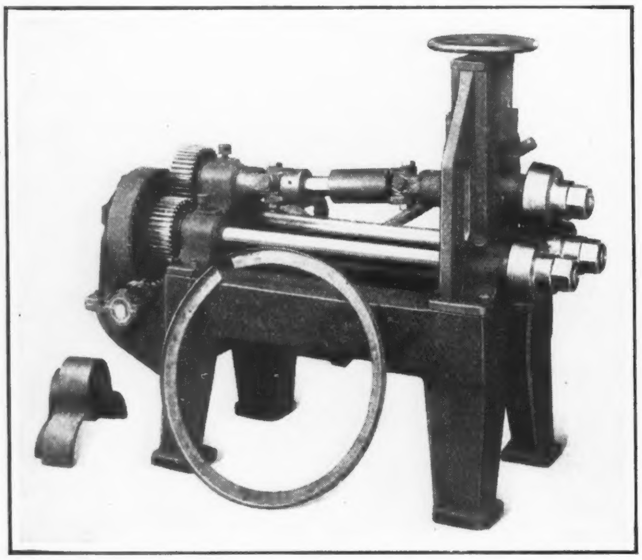


Fig. 1. Ring Coiling Machine made by the Wallace Supplies Mfg. Co.

Although the machine shown in Fig. 2 has been referred to as a pipe-bending machine, it is actually suited for the performance of various other bending operations such as are required in the manufacture of concrete reinforcement rods, angle-irons, flat bars, and other steel sections. It is known as a No. 8 power-driven bending machine, and was especially designed for the purpose of bending reinforcement bars in large quantities. Provision may be made for driving the machine with an independent motor or through a friction clutch and pulleys from a countershaft. The machine has a capacity for handling twisted reinforcement bars up to 1½ inches; and two 1¼-inch bars can be bent at the same time. Similarly, the machine will bend simultaneously an equivalent number of smaller sized bars. By using especially high forming pins and rollers, a quantity of eight or ten small bars may be bent at a time. When several bars are bent in this way, a U-shaped clip is placed over them for convenience in handling. The machine is so arranged that bars may be bent with equal facility from right to left or left to right. This is a great advantage, as it avoids the necessity of reversing bars in order to make all bends, thus effecting a considerable saving of time and labor in handling the material. A special equipment is employed for bending flat bars, round bars, or tubing, squares, channels, angles, tees, flat bars on edge, and various other sections. Where individual motor drive is employed, a 7½-horsepower motor is used. The machine occupies a floor space of 6 by 6 feet, and weighs 3500 pounds.

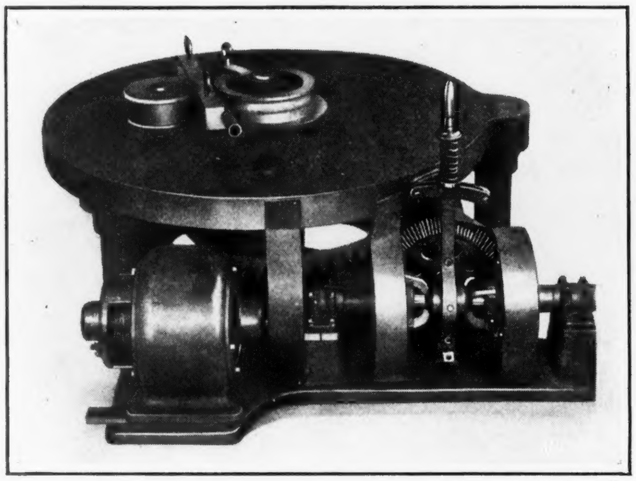


Fig. 2. Pipe-bending Machine made by the Wallace Supplies Mfg. Co.

ROBERTSON POWER SAWS

In MACHINERY for June, 1912, a description was given of a No. 2 "Economy" hacksaw manufactured by the W. Robertson Machine & Foundry Co., 56-58 Rano St., Buffalo, N. Y. This saw has been remodeled, as shown in Fig. 1. It is a 6- by 6-inch capacity draw-cut machine, and is equipped with an arrangement for relieving the teeth of the blade of all drag on the idle or return stroke. This mechanism consists of a two-cylinder pump submerged in oil, which is contained in a tank (not shown). One pump plunger is timed with the crankshaft, while the other is connected to the saw frame.

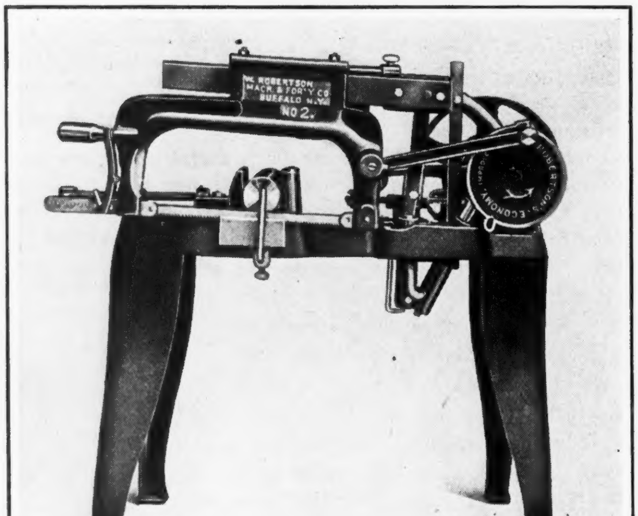


Fig. 1. No. 2 Improved Type "Economy" Saw, built by the W. Robertson Machine & Foundry Co.

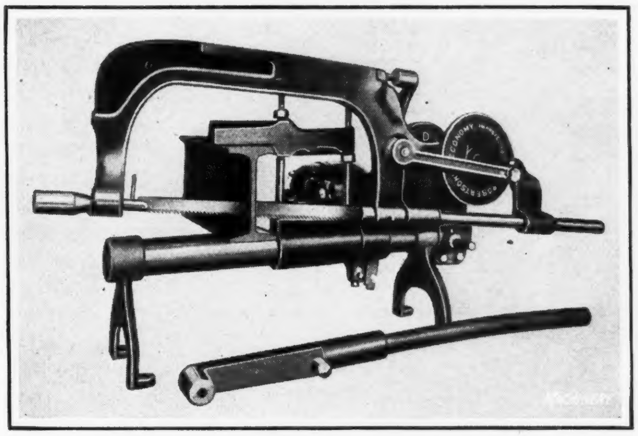


Fig. 2. Portable Power- or Hand-driven Saw built by the W. Robertson Machine & Foundry Co.

At the end of a cutting stroke, the plunger connected to the crankshaft is on the down stroke and forces oil under the plunger connected with the frame, thus causing the saw frame to be raised from the work. At the beginning of the cutting stroke, the pump, being timed with the crankshaft, allows oil to escape and permits the frame to be lowered on the work. The same arrangement has been employed on larger sizes of saws manufactured by this concern. It is said that blades do not become broken by the frame falling on the work. A swivel vise is provided for cutting work to angles up to 45 degrees. The machine is driven by a friction clutch, and stops automatically at the end of a cut.

Fig. 2 shows a portable hand- or power-driven saw, which is also built by the concern mentioned. This machine can be used as a general utility saw when the two legs are applied. The current for driving the motor may be taken from a lamp socket. In cases where current is not available, the lever shown lying at the front of the machine may be used for driving the saw by connecting it to the crank disk and the stationary frame. The machine uses 17-inch blades, and has a capacity for 8-inch work. The motor is coupled to a shaft which, through worm-gearing running in oil, drives the crank-wheel. The latter is connected to the saw frame by the connecting-rod.

MARBURG NUMBERING PUNCHES

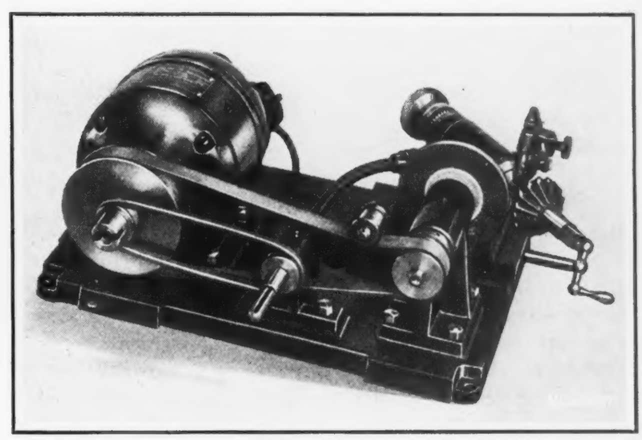
For use in marking various metal parts with numbers, Marburg Bros., Inc., 90 West St., New York City, has recently placed on the market, a set of numbering punches

"All-in-one" Numbering Punches made by Marburg Bros., Inc.

known as the "All-in-one." From the illustration it will be apparent that this name is derived from the fact that all ten numerals are carried by small projections on a disk, so that they are all contained in one piece. Around the circumference adjacent to each projection on which a number is cut, the corresponding number is stamped in the side of the disk; and diametrically opposite, there is cut a corresponding number. Holding the disk edgewise with the numbering punches downward, the lower of the two numbers stamped on the disk indicates the punch that is in contact with the work, and the operator strikes the upper edge of the disk opposite the corresponding figure. A set of numbering punches of this kind would find application for any of the great variety of purposes for which separate tools of this kind are commonly employed.

FRANKLIN PORTABLE UNIVERSAL GRINDER

The Franklin Machine & Tool Co., Springfield, Mass., has recently placed on the market a portable grinder provided with attachments especially designed for use in performing various grinding operations required in automobile repair work. The complete equipment is designated as the Franklin portable repair shop unit Model B, and consists essentially



Portable Grinder made by the Franklin Machine & Tool Co., set up for grinding Valve Reseating Cutter

of a cast-iron base on which is mounted a ¼-horsepower motor, a grinding wheel driven by a flat belt from the motor, and a swiveling head with a spindle mounted on compound slides, which is driven by a flexible shaft. The slides are scraped in, and fitted with adjustable gibs to take up wear; they are fitted with feed-screws that permit the work-holding spindle to be fed toward the face of the grinding wheel and also in a direction parallel with the face.

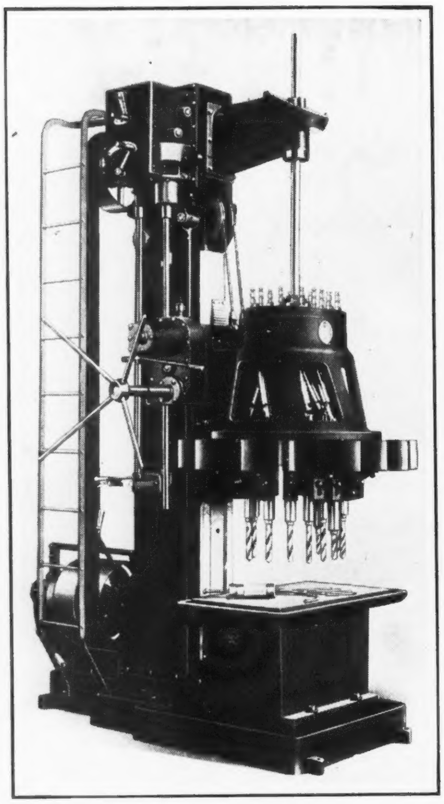
The equipment includes collets for holding valves that are to be reground, and a simple indexing device, shown in the illustration, for use in grinding valve reseating cutters, as well as a flexible shaft equipment adapted for light drilling, buffing, and grinding operations in inaccessible places. Other rotating tools can also be used to advantage with the latter attachment, which is not shown in the illustration. When equipped with a scratch-brush, the latter attachment will make it possible to quickly remove rust from any rust-coated surface, or carbon from cylinder heads, valves, etc. A complete set of attachments for grinding standard types of breaker contacts is also provided, thus making it possible to quickly give pitted contact points the flat contact surface which is so essential to efficient ignition.

An attachment for sharpening reamers, not shown in the illustration, places this tool in the universal grinder class, and gives it a wide range of usefulness. The equipment also includes a line of valve reseating cutters, especially designed to eliminate chatter marks and give maximum

service with one grinding. These cutters, one of which is shown in the illustration in the work-holding spindle, consist of an accurately piloted cutter shank having removable cutters with staggered teeth on both sides. When the teeth on one side become dull, the cutter can be quickly reversed on the pilot of the holder, thus presenting the sharp side to the work.

FOX MULTIPLE DRILLING MACHINE

The Fox Machine Co., Jackson, Mich., has developed and placed on the market a machine called the D-32, which is said to be adapted for the driving of a number of large drills in an economical manner. Not only has it been designed to drive the drills satisfactorily, but this machine has also been arranged to speed up and make easier for the operator the raising and lowering of the head carrying the spindles. This is accomplished by mounting an Ingersoll-Rand "Little David" four-cylinder air-motor on the head. The motor, through the medium of reducing gears, rotates the rack pinion, thereby moving the head up and down at the rate of 7 feet per minute. It is controlled by a special valve at the front of the head in such a manner that it is impossible to engage the air motor and power feed at the same time.



Type D-32 Heavy-duty Multiple-spindle Drilling Machine built by the Fox Machine Co.

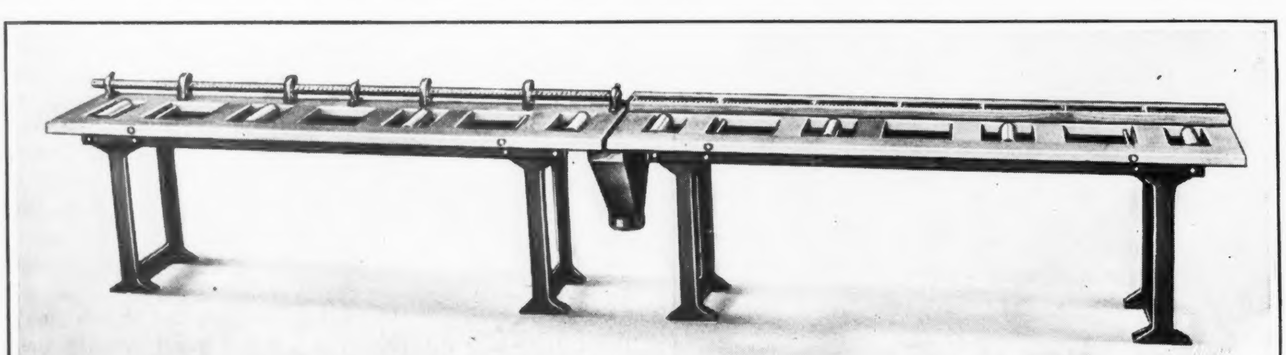
The machine illustrated is a D-32 with a 20-inch round head equipped with twelve spindles, 2 inches in diameter. It can be furnished with heads for large ranges in drilling areas, and for many sizes of spindles. The machine is similar in general construction to the smaller machines built by this firm. The speed and feed changes are obtained by sliding gear transmissions, the gears being flooded with oil from a pump at the base of the column. The gears are all hardened, and Hyatt roller bearings of liberal size are used. The head is mounted on a saddle which permits a longer bearing on the column ways than is possible with a head mounted directly upon the column. This is a particularly desirable feature in a machine of this type, where an enormous pressure is required to force the large drills to their work. The head can be furnished with two speeds to each spindle, so that the speeds of all spindles can be varied independently of one another. All spindles which are not in use may be thrown into a neutral position. The feed is engaged by means of a sawtooth clutch, so arranged that its members are forced apart when the adjustable stop on the side of the column has been reached. This is particularly desirable when drilling blind holes, as the angle of the teeth is such that they cannot cling together.

This type D-32 multiple-spindle drilling machine can be equipped with the Fox tapping attachment, which is built so as to make it possible to reverse the spindles at any time during the tapping operation, and to instantly change the rotation back to the original direction. The load is taken off the entire machine and the taps when the spindle reversal takes place, making the tapping of blind holes an easy operation and eliminating all shock to the machine from the spindle reversal.

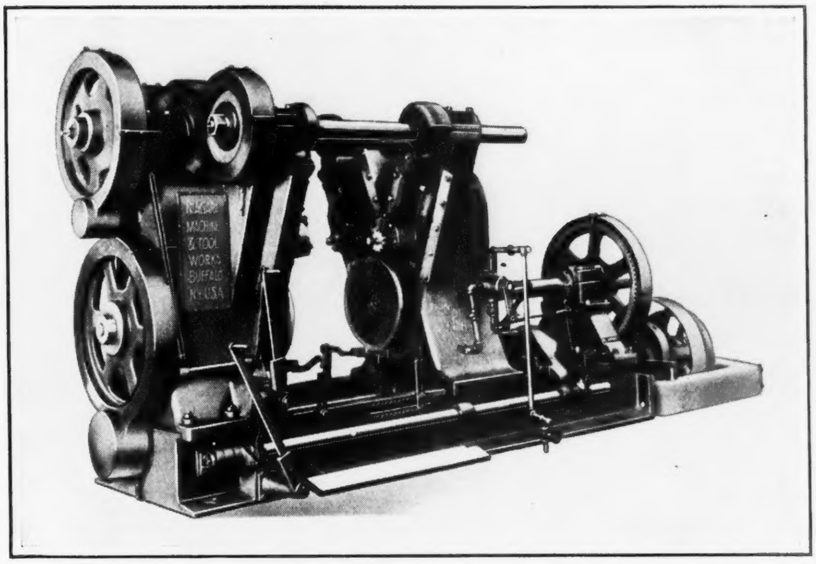
The head of the machine is provided with a power feed in either direction equal to the lead of the taps that are being used, the direction of the feed being controlled by the direction of the spindle rotation. This machine may also be furnished with rotary tables so that loading can proceed at the same time that drilling is being done under the head. This also makes possible the performance of successive operations on the same piece under the head, by indexing the table the required amount. The weight of this machine varies from 9000 to 12,000 pounds.

OLIVER SWING CUT-OFF SAW TABLE

The Oliver Machinery Co., Grand Rapids, Mich., has recently designed and placed on the market a swing cut-off saw table which is illustrated herewith. It is 16 feet long by 19½ inches wide, and 30 inches high. This table is intended for use with an overhead swing cut-off saw. The top is made of kiln-dried rock maple, with angle-iron girths and one-piece cast-iron legs. From the illustration it will be seen that the table is composed of two parts or sections. On the rear of the right-hand section, there is mounted a scale rail graduated in eighths of an inch from 0 to 96 inches. On the left-hand section, there is mounted an Oliver No. 419 automatic swing cut-off saw gage, which comprises a square rod graduated in eighths of an inch from 0 to 96 inches. Four automatic malleable iron stops, one center and two end-rod holders are mounted in place. This automatic saw gage is said to be a saver of considerable time where a number of parts are to be cut off to the same length. After the gage has been set, it is unnecessary to measure any board which is to be cut off to the length designated by the stop. Rollers are inserted in both sections of the table in every other opening for the full length of the table. A dust-chute is fastened between the two sections, having a 6-inch pipe opening connecting to the exhaust system.



Cut-off Saw Table built by the Oliver Machinery Co.



Duplex Double Seamer built by the Niagara Machine & Tool Works

NIAGARA DUPLEX DOUBLE SEAMER

In making metal barrels, four men are employed, by some methods now in use, to provide for double-seaming both ends. A noteworthy saving of labor is accomplished by a horizontal duplex double seamer recently developed by the Niagara Machine & Tool Works, 639-685 Northland Ave., Buffalo, N. Y., which enables one man to successfully take care of this operation. Outstanding features of this machine are that the barrel heads may be readily inserted; barrels can be delivered to and removed from the machine by means of runways; the barrel heads are automatically driven into place; both ends of the barrel are seamed simultaneously; and the rolls are fed automatically. These features result in increased output.

In operating this machine, a barrel with the heads in place, ready for performing the seaming operation, is rolled in on the horizontal bars. The barrel is located on the supports by means of stops, and is raised into line with the chucks by a foot-treadle. The column is then moved into position by the hydraulic cylinder which is controlled by a hand-lever. Pressure thus exerted clamps the barrel between the two chucks, forces the heads into their proper positions, and holds the body during the performance of the seaming operation.

Another hand-lever releases a positive instantaneous clutch and starts the same operation by setting the two camshafts into motion. The curling rolls are automatically brought down to the work to provide for curling the seams, after which these rolls recede and the flattening or finishing rolls move into position and complete the seams. A predetermined number of revolutions allows sufficient time for the proper performance of the work, only about forty revolutions of the chuck or barrel being required to complete the seams. This machine will handle barrels from 18 to 36 inches in diameter, and from 20 to 45 inches in height. Material up to No. 12 gage can be worked in this machine.

NORTON AUTO-PART REGRINDING MACHINE

The Norton Co., Worcester, Mass., has recently placed on the market a special type of grinding machine, adapted for the regrinding of crankshafts, pistons, piston-pins, valves, etc. This machine is illustrated in Fig. 2 and is arranged so that various set-ups required on automobile regrinding work can be easily and quickly made. Both large- and small-diameter grinding can be performed on the machine.

The base of the machine is heavy and rigid, and is supported at three points, which makes it unnecessary to provide special foundations for the machine. The wheel-slide is of extra heavy design, weighing about 900 pounds, and is equipped with a 26-inch diameter grinding wheel which gives ample clearance when grinding crankshafts for long-stroke motors. This heavy slide is moved one-eighth of a thousandth inch for every space that the feed index-pin is moved. Except for the heavier construction, the headstock and footstock are of standard Norton design; they also have longer bearing surfaces on the table. The machine is equipped with a large-capacity coolant pump. The wheel-feed mechanism of the machine is of standard Norton construction and consists of a $3\frac{1}{2}$-inch diameter feed-screw engaging with a half-nut underneath the wheel-slide. The wheel-slide is supported on generously proportioned ways.

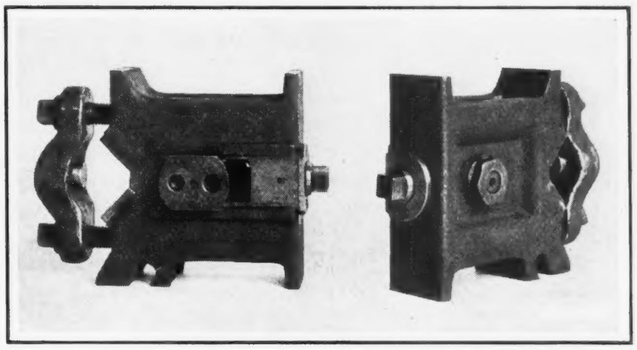


Fig. 1. Type of End-block furnished with Norton Grinding Machine shown in Fig. 2

In order to provide for the many types of crankshafts which the automobile repair shop handles, an adjustable end-block, as shown in Fig. 1, is furnished with the machine, and by the use of blocks of this type no bushings are required for fastening different diameters of shafts in the fixture. A combined center and valve-face grinding attachment is also furnished as a part of the regular equipment of the machine. The attachment is adjustable, permitting the regrinding of the faces of valves of different types. This

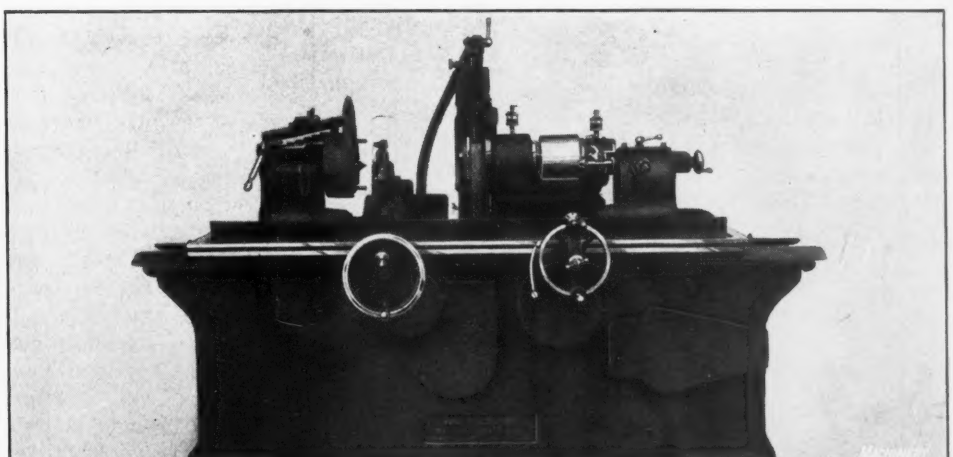


Fig. 2. Grinding Machine for Automobile Regrinding Work, made by the Norton Co.

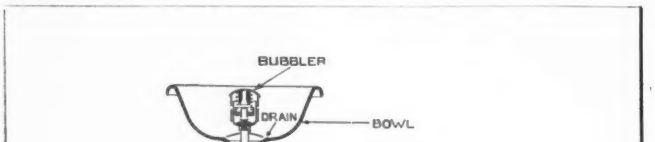
grinding attachment is also used for regrinding the machine centers.

The distance between centers of the machine is 55 inches; the swing, 18 inches; length of bearing ways, 24½ inches; dimensions of large bearing, 3½ inches in diameter by 8 inches long, and of the small bearing, 2 inches in diameter by 6 inches long. There are twelve work-speeds, ranging from 20 to 207 revolutions per minute, and the table of the machine is operated by a two-speed hand-feed apron. The machine weighs 7600 pounds.

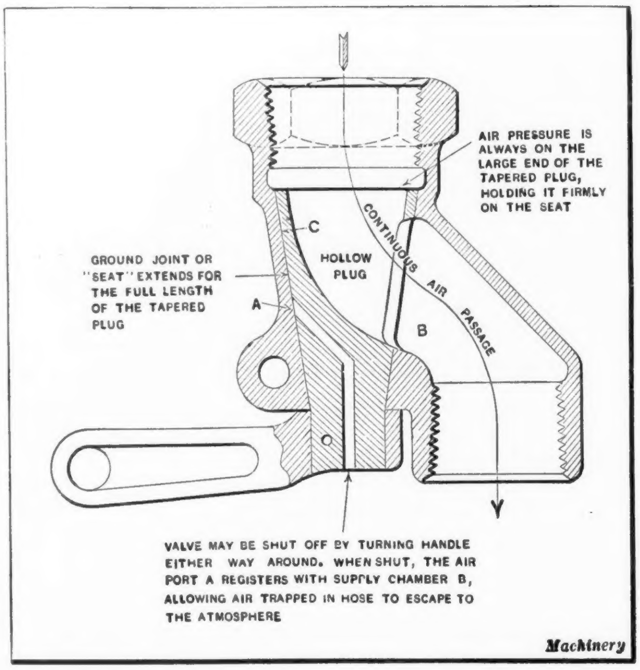
"ECONOMIZER" FOUNTAIN

The "Economizer" combination ice- and water-cooled fountain shown in section in the accompanying illustration has recently been perfected by the Manufacturing Equipment & Engineering Co. of Boston, Mass. The novel feature of the "Economizer" fountain is that there are two coils provided for the circulation of the water, and two cooling compartments. One of the coils is cooled by the direct contact of the ice, and the other by the cold water which is wasted during drinking. This water returns to a lower compartment in which the water-cooled coil is contained. It is stated that by using the waste water to pre-cool the water before it passes to the ice-cooled coil, a considerable saving in ice is realized.

As a means of assuring long usage, the coils are made of copper rather than of brass. Either the inclined or vertical stream or bubbler can be used in connection with this fountain. The bowl may be of varied design, but the type usually furnished with the fountain is an elliptical one with provision for delivering an inclined stream, and a cowl guard provided for sanitary purposes. The design of the "Economizer" makes provision for adapting the attachment to various designs of ice-cooled fountains already in use. The matter of establishing sanitary conditions for supplying drinking water for the accommodation of a considerable number of employes is an important hygienic consideration.



Sectional View of Water-cooler, made by the Manufacturing Equipment & Engineering Co.



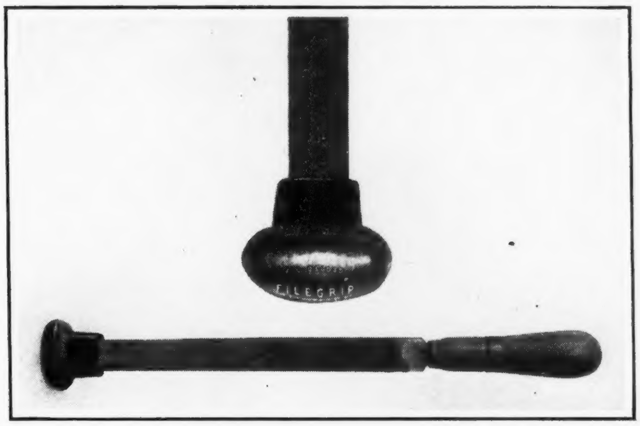
"Cleco" Pressure-seated Air Valve made by the Cleveland Pneumatic Tool Co.

"CLECO" PRESSURE-SEATED AIR VALVES

The Cleveland Pneumatic Tool Co., Cleveland, Ohio, has recently brought out an air valve for general service, which contains new features of interest to all users of compressed air. The sectional illustration shows this new valve, which is designed to eliminate air losses through leakage in transmission. The destructive action of compressed air upon valve seats, packing, and gaskets is well known, and there has been for some time a demand by air users for a valve that would stand up in high-pressure pneumatic service. In view of this fact, it was decided by the engineers of the Cleveland Pneumatic Tool Co. to design a valve in which the air could not come into contact with the seat, thus avoiding replacement of this part, and also to utilize the air pressure as a seating agent to hold the valve plug down. This design eliminates the use of packing, gaskets, stems, and springs, and reduces the valve parts to three, namely, the body, plug, and handle.

This was successfully accomplished by using a hollow tapered plug with the large end uppermost, the air entering at the top, and passing through and out of an opening in one side of the hollow plug into the supply chamber which connects directly with the air hose, without coming into contact at any time with the valve seat, which is the outer wall of the plug, as indicated by the letter *C* in the illustration. The long arrow shows the direction of the air in its travel through the wide unobstructed air passage of the valve, which is free from any angular turns to impede its progress. The short arrow indicates the point on the large end of the plug where the air pressure is constant, forcing the tapered plug against the walls of the valve body and forming a perfect seat.

The valve is provided with a waste arrangement, to allow the accumulated pressure in the air hose to escape when the valve is shut off, consisting of air ports *A* and *B*. This is to safeguard the operator, who, when disconnecting the hose from the valve, often receives a gush of air in the face and accidentally gets scale or grit in his eyes. This new valve has been subjected to very severe service tests under both high and low air pressures, the high pressure being 500 pounds, as well as submerged water tests, and it is said to have successfully passed the most exacting tests that could be devised on liquids under pressure and on acetylene gas lines.



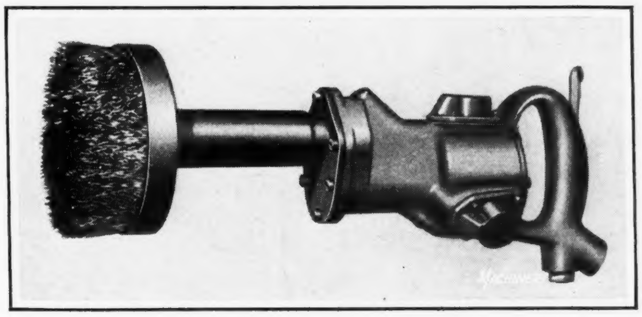
Safety File-grip made by the J. L. Osgood Tool Co.

OSGOOD SAFETY FILE-GRIP

To afford a convenient means for a machinist to hold the outer end of a file, the J. L. Osgood Tool Co., 45 Pearl St., Buffalo, N. Y., has recently placed on the market a pliable rubber grip which can be slipped on the end of a file and prevents the left hand from being cut or becoming sore by constant pressure on the teeth. It is also claimed that this grip assists in holding a file flat on the work, thus improving the quality of filed surfaces. Attention is called to the fact that a file equipped with one of these grips is found useful as a soft-faced mallet for lightly hammering finished surfaces; also, this grip prevents injury to finished surfaces if a file is accidentally dropped on the work. These grips are made to fit files of all shapes and sizes.

INGERSOLL-RAND AIR-OPERATED WIRE BRUSH

The use of a wire brush for cleaning metal surfaces offers an opportunity for effecting a considerable saving of time and labor over that required to do such work by hand. A brush is adapted for removing paint, rust, scale, and dirt from metal surfaces. However, it has been difficult to obtain a wire brush of proper design and made of the right materials to work effectively on an air motor and not wear out too rapidly. A wire brush of very rugged design has recently been placed on the market by the Ingersoll-Rand Co., 11 Broadway, New York City, for use with its standard No. 6 "Little David" pneumatic drill. It is a brush with a face diameter of 5 inches, and is made up of wires of a special heat-treated steel that has been found to have very good wearing qualities. It is sturdily constructed and will stand up under severe service.



"Little David" Air-operated Wire Brush made by the Ingersoll-Rand Co.

This brush is manufactured particularly as an attachment for the No. 6 drill (as illustrated), this type of machine being especially suited for work of this nature. The drill has liberal bearings to take up all the end thrust when pressing down on the work; and it is furnished with a high-speed motor. Moreover, it is of light weight and small over-all dimensions, and can be used in sharp corners and other cramped spaces. The whole unit weighs only 11½ pounds. The wire brush outfit is very useful for cleaning iron, steel, and aluminum castings.

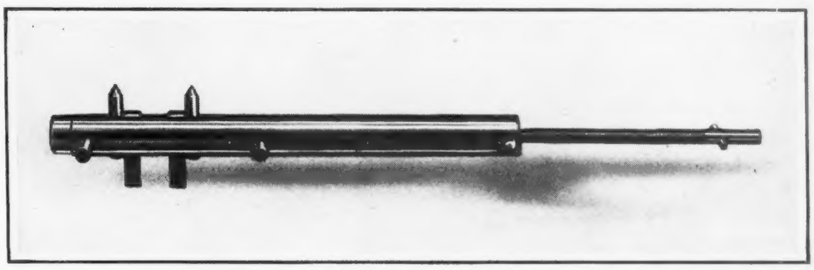
PORTABLE PLATE DRILLING MACHINE

The portable plate drilling machine shown in the accompanying illustration is the patented product of E. L. Fogleman, Box 245, Balboa, Canal Zone. While the illustration shows quite clearly the construction of the machine and its method of operation, it should be mentioned that it has a capacity for drilling holes to any depth up to 6 inches, and the design is such that the drill will always be maintained in a position at right angles to the surface of the work, regardless of whether or not the work is held in a horizontal position. While the machine is intended primarily for drilling and countersinking holes with the tool held at right angles to the base of the work, it is a simple matter to drill holes at any desired angle by adjusting the screw shown in contact with the work at the right of the drill.

Portable Plate Drilling Machine designed by E. L. Fogleman

VAN KEUREN MICROGAGE ACCESSORIES

The addition of a set of accessory measuring tools, for use with the combination microgages manufactured by the Van Keuren Co., 362 Cambridge St., Allston, Boston, Mass., completes and greatly adds to the utility of this company's line of measuring tools. As shown in the accompanying illustration, these accessories are designed to secure rigidity, simplicity of parts, accuracy, and utility. The microgages, which are round in shape, permit the use of a light yet strong and rigid steel tubing for the frame or clamp to hold the microgages and the accessory jaws. They are inserted in the lower or open end of the tube, and the jaws



Microgage Accessories made by the Van Keuren Co.

are inserted in ¼-inch slots as shown. The three sets of staggered slots, instead of one long slot, retain the rigidity of the steel tube, and assure perfect alignment of the measuring jaws. Pressure on the clamping screw releases a button at the top of the tube and permits the clamping screw to be moved quickly to accommodate any combination of gages or jaws. The clamp has a range up to 7 inches. Small dimensions are secured with the jaws in the central slot; and for long combinations, the two end slots are used.

The measuring jaws include two flat jaws 0.300 inch in thickness, two plain 0.250-inch plugs, and two 60-degree–0.250-inch scribing plugs. A base block 1.000 inch in thickness, which is held in place by one of the 0.250-inch plain plugs, permits measurements to be established at a definite height above a surface plate. The two flat jaws are of a definite thickness, and when separated by the desired combination of gages, they may be used for making either inside or outside measurements. The plain 0.250-inch plugs are likewise used for the measurement of diameters of holes or of the smallest or largest distance between parallel holes. The 60-degree—0.250-inch plugs are used for trammel points, for checking the lead of threads, and for scribing lines and locating height dimensions. As all of the measuring parts are of extremely simple construction, embodying plain flat or cylindrical surfaces, they are claimed to be as accurate as the microgages themselves. This simplicity of construction also facilitates manufacture and thus reduces the cost of production.

NEW MACHINERY AND TOOLS NOTES

Steam Tractor Crane: Locomotive Crane Co. of America, Champaign, Ill. A small steam tractor crane for operating a ¾-cubic yard clam-shell bucket. The steam engine is of a double-cylinder, throttle, reversing type. The weight of the crane is 29,000 pounds.

Line-reamer: New Britain Tool & Mfg. Co., Inc., New Britain, Conn. An expansion reamer known as the "line-reamer," intended primarily for use in garages and automobile repair shops in reaming the worn holes of pistons and other engine parts to standard over-size dimensions.

Flexible Coupling: Ajax Flexible Coupling Co., Westfield, N. Y. A flexible shaft coupling consisting of two flanges into which are fitted bolts that project from one flange to the other and pass through flexible members, the heads of the bolts being placed alternately on opposite sides. The coupling is insulated to make it suitable for electric drives.

Rotary Oil-pump: S. F. Bowser & Co., Inc., Fort Wayne, Ind. A motor-driven rotary oil-pump intended for unloading tank cars, supplying oil to furnaces, and transferring oil from one floor to another in a plant. A foot-valve is furnished with each outfit, and a gage indicating pressures up to 100 pounds is mounted on the upper end of the air chamber.

Grinders: J. L. Austin Mfg. Co., Milwaukee, Wis. Three sizes of power-head grinders which can be furnished either with or without a pedestal and with either a single or double pulley drive. The rest arms are equipped with both an angle and a bevel tool rest. The dimensions of the wheel on the various sizes are 8 by 1 inch, 10 by 1½ inches, and 12 by 2 inches.

Reamer Grinding Attachment: G. L. Wood, 61 Stafford St., Worcester, Mass. A grinding attachment particularly adaptable to hand expansion reamers with pilots, but applicable as well to machine reamers, pin cutter bars, boring-bars, and taps. In grinding expansion reamers, the reamer is expanded from 0.001 to 0.002 inch according to the dullness, and then ground to size.

Rotary Indexing Table: Rhodes Mfg. Co., Hartford, Conn. An 8-inch diameter rotary indexing table, intended primarily for use with the shapers built by this firm, but which may also be used on milling and drilling machines, etc. Three index-plates are provided to permit any number of divisions up to 360 to be obtained. The rotary table is graduated in degrees to facilitate making angular settings.

Tool-hardening Furnace: Advance Furnace & Engineering Co., Springfield, Mass. A small furnace designed for tool-hardening and for the heat-treatment of small parts. It is of the semi-muffle type with the flame chamber located below the floor of the heating chamber, the latter being heated through flues. The burner, which is located in the rear of the furnace, may be adapted for burning either oil or gas.

Electric Crane Truck: Elwell-Parker Electric Co., Cleveland, Ohio. The low-bed electric industrial truck manufactured by this concern has been fitted with a crane to adapt it for loading, hauling, and tiering. The crane can lift pieces weighing up to 2000 pounds and can stack material to a height of eight feet. The power unit for the crane consists of a motor, controller, hoisting mechanism, and battery.

Shaper: Rhodes Mfg. Co., Hartford, Conn. The shaper manufactured by this concern has been provided with a knee that may be swiveled to any angle, and has been made an independent unit by providing brackets on the column for supporting a ½-horsepower driving motor. The machine and motor are prevented from injury due to accidental stalling by the interposition of a countershaft between the motor and the machine.

Electric Storage-battery Tractor: Atlas Car & Mfg. Co., Ivanhoe Road, Cleveland, Ohio. An electric storage-battery tractor, 7 feet long and 40 inches wide, which may be equipped with either a two- or four-wheel drive and has three speeds in either direction. The battery equipment consists of forty-two alkaline or twenty-four lead storage batteries. The weight of the tractor with the batteries is approximately 3900 pounds.

Drafting Outfit: Simplex Tool & Instrument Co., 820 N. Third St., Camden, N. J. A drafting outfit consisting of a frame supporting a drawing board on which is mounted a parallel ruling device to which scales are fastened. The drawing board may be placed in either a horizontal or a vertical position. A sliding horizontal board beneath the main board forms a table to hold reference drawings and also serves as a desk for clerical work.

Scrap-baling Press: Reeves-Boggs Machinery Co., 2926 Grand Ave., Chicago, Ill. A line of four machines for baling scrap, the two smaller sizes of which make bales 5 by 5 by 10, and 5 by 5 by 12 inches, respectively. These machines are intended for baling skeleton punchings of sheet brass, copper, aluminum, and other soft metals. The two larger presses make bales 12 by 12 by 12, and 14 by 14 by 16 inches, respectively, and are suitable for sheet-metal scrap of No. 14 gage and lighter.

Rebabbitting and Reboring Outfits: Detroit Garage Equipment Co., 268 Jefferson Ave., Detroit, Mich. A line of equipment for rebabbitting and reboring the crankshaft bearings of automobile and other gasoline engines. A two-quart combination blow-torch and melting pot is included. This company also makes a cylinder reboring outfit, intended for reboring and burnishing the cylinders of Fordson and Ford Model T motors; this outfit is used in connection with upright drilling machines.

Wheel-bushing Chuck: Commercial Welding & Machine Co., Inc., 21 Commercial St., Worcester, Mass. A chuck developed to facilitate the bushing of grinding wheels. The design embodies two independent chucks, one of which holds the bushing arbor, and the other, the wheel or part to be bushed. It is claimed that the chuck is centered accurately and that the hole is produced at right angles to the side of the wheel. The chuck is made in an 18-inch size and mounted on three legs. A lathe chuck is also built for use in turning abrasive wheels.

Double-crank Press: Toledo Machine & Tool Co., Toledo, Ohio. A large double-crank press developed especially for use in the manufacture of automobiles. It may be used for blanking, forming, and perforating side rails and running boards, for blanking and forming certain kinds of cross-members and rear axle housings, fenders, aprons, doors, etc. A cam-actuated stripper and clamping device is provided for use in connection with perforating dies, while a spring-pressure drawing attachment is also provided for use with forming dies. A power elevating device raises and lowers the slide when setting the dies.

Horizontal Boring and Drilling Machines: Jones Machine Tool Works, Philadelphia, Pa. Two machines, one for horizontal drilling and the other for horizontal boring and drilling. The No. 3 drilling machine is driven by a 3½-horsepower variable-speed motor. The spindle has a horizontal traverse of 20 inches, the forward feed being by hand or power and the reverse by hand only. The saddle has a vertical traverse of 30 inches, and the column a transverse movement of the same amount. The table can be tilted 45 degrees from the horizontal, either toward the spindle or away from it. The No. 3 boring and drilling machine is similar to the drilling machine, except that the base is lengthened to provide for supporting the boring-bar and facing head when cylinders, etc., are being machined.

NEW BOOK ON MATHEMATICS FOR THE SHOP MAN

ARITHMETIC, ELEMENTARY ALGEBRA AND LOGARITHMS. By Erik Oberg. 121 pages, 6 by 9 inches. Published by THE INDUSTRIAL PRESS, 140-148 Lafayette St., New York City. Price, $1.

In the present volume the subjects of arithmetic, algebra, and logarithms have been dealt with in a manner quite different from that found in ordinary text-books. It has been the object of the author to give to the practical man engaged in the industries an elementary text-book from which he may gather such information on the subject as will enable him to solve the everyday problems encountered in machine design and shop practice. Theoretical discussions of the mathematical principles upon which the methods of arithmetic, algebra, and logarithms are based have been avoided, and an effort has been made to impart simply a working knowledge of the use of the processes involved. By an hour's study each day for a brief period anyone familiar with the first principles of arithmetic should be able to acquire a sufficient knowledge of the mathematical subjects dealt with in this book to enable him to apply to his daily work the simple methods of mathematics explained. In the chapters on algebra, as well as on logarithms, numerous examples are given for the student to work out, in order that he may acquire sufficient practice to enable him to use the methods in everyday practical shop problems. Logarithmic tables, in large clear type, are also included. No attempt has been made to prove the rules given. Instead, the rules and formulas are stated as matters of fact—like tools to be used by the practical man. In other words, the book is a text-book, not on mathematics, pure and simple, but on the application of arithmetic, elementary algebra and logarithms in machine design, shop practice, and industrial work in general.

* * *

STATEMENT OF THE OWNERSHIP, MANAGEMENT, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912

of MACHINERY, published monthly at New York, N. Y., for April 1, 1921.

State of New York }
County of New York } ss.

Before me, a Notary Public in and for the state and county aforesaid, personally appeared Matthew J. O'Neill, who, having been duly sworn according to law, deposes and says that he is the treasurer and general manager of The Industrial Press, Publishers of MACHINERY, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, The Industrial Press	140-148 Lafayette St., New York
Editor, Erik Oberg	" " " " "
Managing Editor, None	
Business Managers:	
Alexander Luchars, President	" " " " "
Matthew J. O'Neill, Treasurer and General Manager	" " " " "

2. That the owners of 1 per cent or more of the total amount of stock are:

The Industrial Press	140-148 Lafayette St., New York
Alexander Luchars	" " " " "
Matthew J. O'Neill	" " " " "
Louis Pelletier	" " " " "
Erik Oberg	" " " " "
H. L. Ketchum	" " " " "
E. Y. Urban	" " " " "

3. That there are no bondholders, mortgagees, or other security holders.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

MATTHEW J. O'NEILL, General Manager

Sworn to and subscribed before me this 31st day of March, 1921.

WILLIAM E. BACON,
Notary Public, Kings County No. 444

(SEAL)

Kings Register No. 3109
New York County No. 79
New York Register No. 3047
(My commission expires March 30, 1923.)

MATCH PLATE DRILLING MACHINE

The special drilling machine illustrated herewith was recently designed and constructed by the Langelier Mfg. Co., Providence, R. I. This machine is intended for drilling hundreds of holes in plates used for holding matches while they are being dipped in a phosphorus bath. The machine is of the column-and-knee design, and has a box-type base to which the column is bolted. It is belt-driven and is provided with hand feeds throughout. The knee carries the saddle, supported by flat cross-ways *A*, Fig. 2, the table of the machine being adjusted transversely by the hand-lever *B*. The shaft to which the hand-lever is attached is supported in bearings from the saddle. These bearings are located far enough apart to allow the required longitudinal travel of the table, during which movement the shaft slides through bearing *C*.

The saddle also carries a double-tooth pawl *D* which limits the longitudinal movements of the table, this pawl being

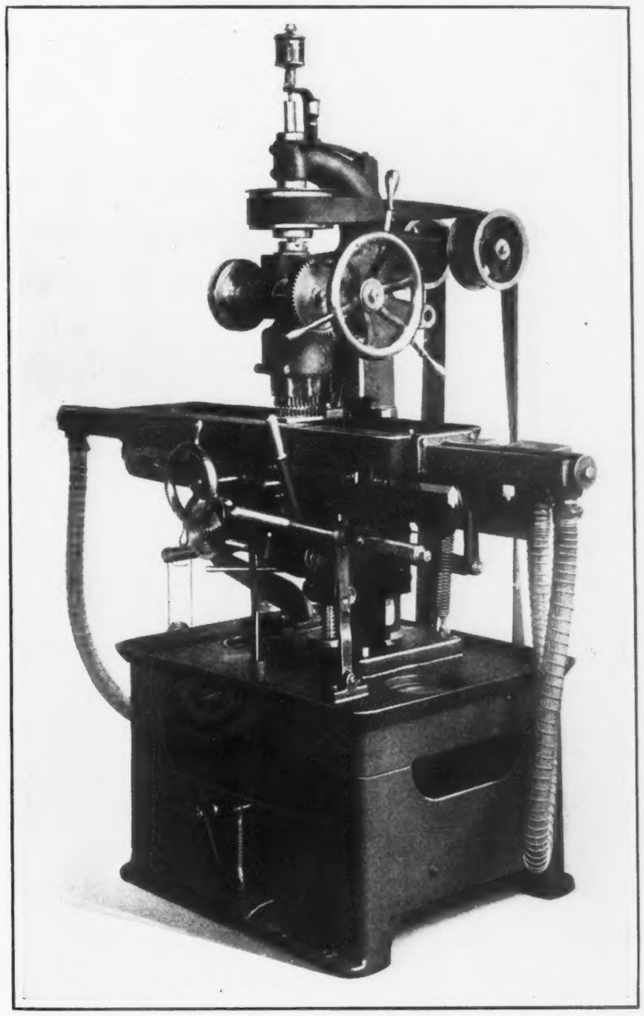
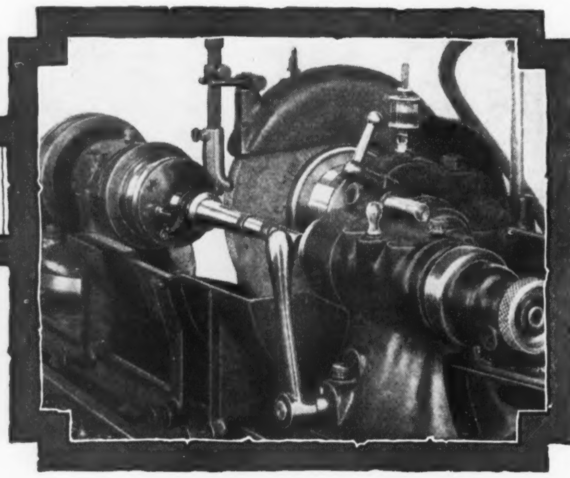


Fig. 1. Langelier Match Plate Drilling Machine

connected by a vertical bar to the foot-treadle, by means of which the pawl is disengaged. By designing the pawl with two teeth, the amount of wear caused by its frequent use in indexing the machine table is distributed over twice the area that would be in engagement if a pawl having but one tooth were used. A steel rack *E*, in which saw-teeth are cut at the desired intervals, is attached to the table of the machine by bolts, and its position may be longitudinally adjusted as required when setting up the machine.

The machine has two special features—the multiple drill head *F*, and the coolant system. The multiple drill head is a special Langelier product. The spindles are located on fixed centers in a hard phosphor-bronze bearing head. These spindles are made from alloy steel bar, hardened, heat-treated, and ground to size. They are provided with special chucks for taking straight-shank tanged drills. There are



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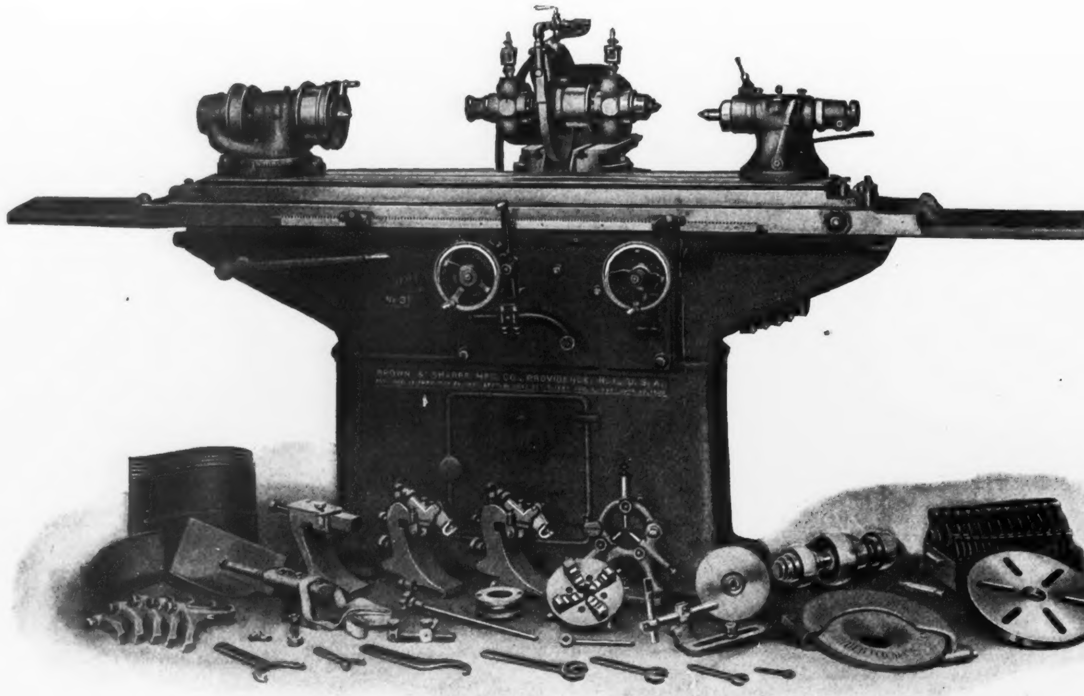
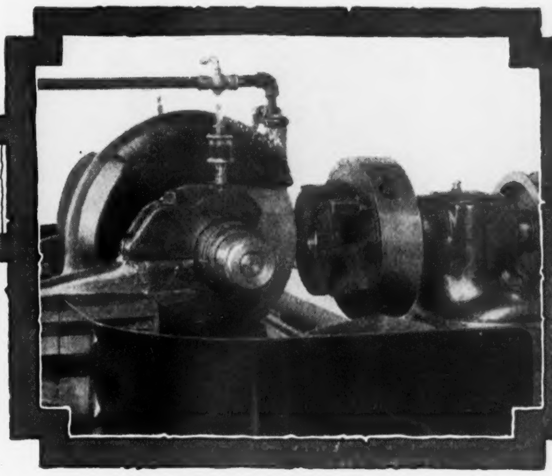
The usefulness of a Brown & Sharpe Universal Grinding Machine is soon apparent in the shop having a wide variety of work at hand. The handiness of any one of the four sizes is such that they prove profitable in every shop. The quick setting up features make these versatile machines valuable on the manufacturing floor as well as in the tool-room.



BROWN & SHARPE MFG. CO.

GRINDING MACHINES



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The wide range of work to which they are readily adapted not only includes straight and taper grinding but internal and external grinding and such operations as shown in the illustrations, as well as tool and cutter grinding.

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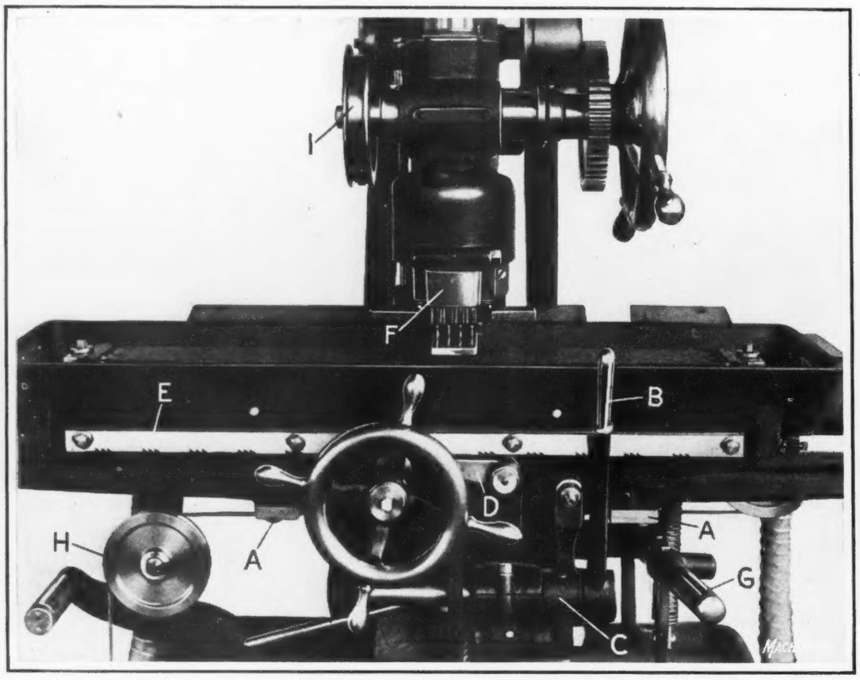


Fig. 2. Close-up View of Langelier Drilling Machine, showing Special Features

no gears of any kind used in the construction of these drill heads, the spindles being of the crank type, driven from a phosphor-bronze driving plate. This spindle driving plate is carefully balanced to eliminate practically all noticeable noise and perceptible vibration when the drills are operated at their recommended speeds. The drills are arranged in straight rows and in quantities to suit the convenience of the special jobs for which they are constructed. For the work here considered, there are three sizes of heads used, having eighteen, twenty-four, and thirty-two spindles, respectively. The spindle of the machine is drilled eccentrically to receive the straight shank of the drill head, and this eccentricity gives the throw to the driving plate by means of which the spindles are operated. The drill head is furnished with thrust ball bearings, and the ends of the drills are guided by a jig plate which may be adjusted vertically to suit the length of drills used.

The other special feature is the coolant system. The coolant is contained in an enclosed sheet-metal tank attached to brackets at the rear of the column. These brackets may be swung upward to tip the tank, by operating hand-lever *G*. The tank is connected by a hose which permits the coolant to flow into the table tray and flood the work. There are screened openings at each end of the table, to which the hose is connected for returning the coolant to the supply tank, but the liquid will not flow back until the hand-lever *G* has been raised, thereby swinging the tank down below the level of the fluid in the table tray. As soon as this level has been passed, the table is quickly drained, allowing access to the work for removing it.

Four examples of the type of work for which this machine is used are shown in Fig. 3. In the first plate at the top the 576 holes are arranged in twelve rows of forty-eight holes each, and a twenty-four spindle drill head, having four rows of six drills each, completes the drilling of the plate in twenty-four settings of the machine table. The holes in the second match plate are in twelve rows, seventy-two to a row, and an eighteen-spindle drill head drills this plate in forty-eight settings of the table. The third match plate, containing 832 holes arranged in rows of 104, requires twenty-six settings of a thirty-two spindle drill head. The fourth plate is made of steel instead of cast iron and is drilled similarly to the plate above it, in twenty-six index movements of the table.

A separate fixture is required for each plate. These fixtures are of extremely simple design, being provided with a tongue that fits the slot in the machine table, and having spring stops to engage the end of the work. The work is prevented from springing under the pressure of the tools by knurled adjusting nuts placed quite close together in the base of the fixture. After the plate has been clamped down on the fixture, the table is run to the extreme left, at which point the pawl *D* is engaged with the two notches at the extreme right-hand end of the index rack *E*. The hand-lever *G* is then lowered, and becomes locked in this position while the coolant is permitted to flow on the work and cover it.

As soon as one cluster of holes has been drilled, the foot-lever is operated, withdrawing the pawl from the index rack, and the table is fed to the right a distance of 3/10 inch, which in this case is the spacing between holes in the work. This center-to-center distance of the holes is so short that it is impracticable to drill successive holes at once; therefore the head is so designed that the distance between the drills provides for drilling every other hole at each setting. Located in the second position, the operation is repeated on the second quantity of holes, and then the table is indexed to the first of the next three index notches, and from then on to the end of the table travel the operations are repeated. When the table has been indexed, step by step to the right, and all the holes in a row have been drilled, hand-lever *B* slides the table forward 3/10 inch, thus relocating the work for its second lengthwise traverse.

The table is returned by a weight hanging over sheave *H*, which operates as soon as the pawl is released, and brings the table against a spring buffer at the left of the machine. After one table traverse is completed, lever *G* is raised, lowering the coolant tank and permitting the flooded work to be drained. The spindle is raised by a spring attached to flanged pulley *I*, carried on the feed-shaft. This shaft has a spur gear near the handwheel, for use with power feed. The machine weighs approximately 2600 pounds.

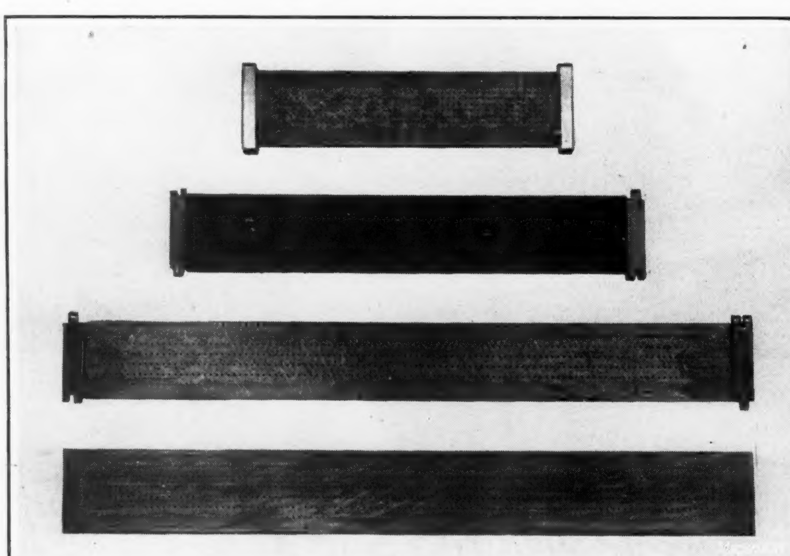


Fig. 3. From Top to Bottom: 3/16 Iron Plate—576 Holes—No. 41 Drill—8 Minutes; 3/16 Iron Plate—864 Holes—No. 36 Drill—14 Minutes; ½ Iron Plate—832 Holes—No. 38 Drill—18 Minutes; ¼ Steel Plate—832 Holes—No. 38 Drill—12 Minutes

PERSONALS

DR. ALBERT SAUVEUR, professor of metallurgy at Harvard University, has been elected an honorary member of the American Society for Steel Treating.

GLENN MUFFLY, formerly sales manager of the Lees-Bradner Co., Cleveland, Ohio, has become sales manager of the Miller Shock Equalizer Co., of Cleveland.

C. EARLE SMITH of the National Twist Drill & Tool Co., Detroit, Mich., has recently been elected a member of the board of directors, and is now secretary and sales manager of the company.

B. FORTUIN, formerly secretary and treasurer of the Duke Steel Co., Inc., 191 Pearl St., New York City, is now president and treasurer, succeeding W. B. DUKESHIRE, who is no longer connected with the company.

D. W. PATTEN, formerly connected with the New Britain Machine Co., New Britain, Conn., in the capacity of salesman in the northern Ohio district, is now associated with the Hess-Schenck Co. of Cleveland, Ohio, in a similar capacity.

A. E. HACKETT has been placed in charge of the Detroit office (1724 Dime Bank Bldg.) of the Federal Machine & Welder Co., of Warren, Ohio. This office was formerly in charge of Arthur E. Meyer, who resigned on account of ill health.

CLYDE E. DICKEY has resigned his position as general manager of the Hammond Steel Co., Inc., Syracuse, N. Y. Mr. Dickey is president of the Dickey Steel Co., Inc., 233 Broadway, New York City, and will devote all his time to this company in the future.

EDWARD C. MCSHEEHY, formerly manager of the David A. Wright Machinery & Equipment Co., Chicago, Ill., is now representing the Steel & Tube Co. of America, and the Mark Mfg. Co. of Chicago, in the Colorado, Wyoming, and Montana oil fields, with headquarters in Denver.

STANLEY MAZUREK, JR., has been placed in charge of the Chicago office at 15 S. Clinton St., of the Federal Machine & Welder Co., of Warren, Ohio. Mr. Mazurek has been assisting in the selling organization for some time, but now assumes full control of the Chicago office.

JOHN J. SWAN, formerly associated with the Prest-O-Lite Co., Indianapolis, Ind., has become connected with the Engineering Business Exchange of New York City. Mr. Swan was for a time one of the editors of the *Engineering News*, and later held engineering and executive positions with the Ingersoll-Rand Co., Chicago Pneumatic Tool Co., Keller Mfg. Co., and the American Arms Corporation.

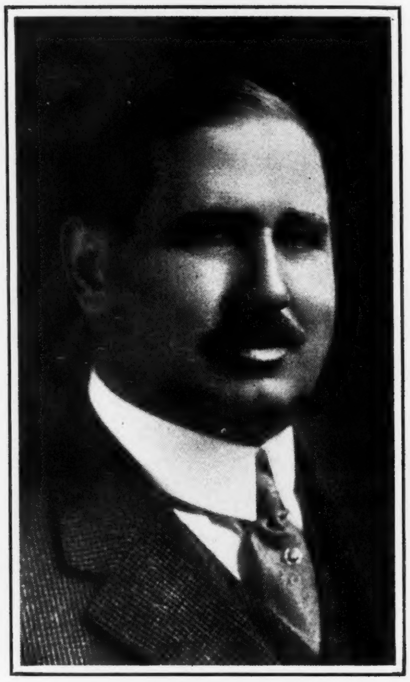
D. C. PAUL, formerly with the Gaul, Derr & Shearer Co., Philadelphia, Pa., is now representing the Black & Decker Mfg. Co., Towson Heights, Baltimore, Md., in Pittsburg, Pa., with headquarters at 303 Penn Ave. The Pittsburg branch, of which Mr. Paul is manager, includes western New York, western Pennsylvania, and the northern part of West Virginia. A completely equipped service station is maintained at this branch, with a factory trained service man in charge. Mr. Paul is assisted by Frank E. Marrion and J. A. Miller.

HOMER J. FORSYTHE, manager of the construction division of the engineering department of the E. I. Dupont de Nemours & Co., Inc., Wilmington, Del., has been transferred to the position of assistant general manager of the Hyatt Roller Bearing Co., at Newark, N. J., a subsidiary of the General Motors Corporation. He had been with the engineering department of the company since August, 1906. During the war he was made manager of the combined Wilmington shops, one of the major divisions of the Dupont Engineering Co., which was engaged in the construction of materials for the war plants. At the end of the war he was promoted to the position of manager of the construction division of the engineering department, which he held until his recent transfer.

FREDERICK M. FEIKER, vice-president and chairman of the editorial board of the McGraw-Hill Co., Inc., New York City, has been appointed personal assistant to Herbert Hoover to organize and develop those branches of the Department of Commerce which relate directly to commerce and industry. Mr. Feiker is an electrical engineer by profession, and has been especially interested in aiding Mr. Hoover in the development of his plan for the elimination of waste in industry, which was undertaken by the Federated American Engineering Societies at Mr. Hoover's suggestion. He is a graduate of the Worcester Polytechnic Institute, and was for several years chairman of the editorial board of the A. W. Shaw publications of Chicago. He has been managing editor of *Factory*, and editor-in-chief of the *Electrical World*, and in 1916 established *Electrical Merchandising*. Mr. Feiker hopes to be able to assist Mr. Hoover in the development of the statistical and research branches of the Government in such a way as to provide information and help for the needs of the average business man and the small manufacturer.

NEW PRESIDENT OF MANNING, MAXWELL & MOORE, INC.

J. M. DAVIS, formerly vice-president of the Baltimore & Ohio Railroad, has been elected president of Manning, Maxwell & Moore, Inc., 119 W. 40th St., New York City, to succeed the late A. J. Babcock. Mr. Davis has served as superintendent of the Great Northern Railway, of the Erie Railroad at Scranton, Pa., and of the Allegheny Division, as well as of the Oregon short line and the Central District of the Southern Pacific. He entered the service of the Baltimore & Ohio Railroad in January, 1914, and later in the same year was appointed general manager of the Baltimore & Ohio, Southwestern - Cincinnati, Hamilton, and Dayton lines. In 1916 he was appointed vice-president in charge of operation and maintenance of the Baltimore & Ohio System, and held that position until July, 1918, when under federal control of the railroads he was appointed manager of the New York properties of the Baltimore & Ohio Railroad, including the Staten Island lines. In September, 1919, he left the Baltimore & Ohio Railroad to become president of the Rock Hill Iron & Coal Co. and associated corporations, with headquarters in New York.



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OBITUARIES

ROBERT L. BRIDGMAN, New England representative of the L. S. Starrett Co., Athol, Mass., died suddenly at his home in Belchertown, Mass., May 7, aged sixty-seven years. Previous to 1908, when he became connected with the L. S. Starrett Co., he served for over thirty years as representative of the Athol Machine Co., traveling over a large portion of the United States.

THOMAS L. SMITH, founder of the T. L. Smith Co., Milwaukee, Wis., manufacturer of tilting mixers, excavators, crushers, etc., died April 29 at his home in Milwaukee, aged sixty-six years. Mr. Smith was born in England in 1855, and came to this country with his parents at the age of four. He graduated from the Iowa State College at Ames, Iowa, in 1877, and later took a supplementary course in engineering at the Massachusetts Institute of Technology. The early part of his career, immediately following his college life, was spent in drafting and engineering work with a number of large manufacturers in Milwaukee, including the Allis-Chalmers Co., Pawling & Harnischfeger Co., and Kempsmith Mfg. Co. In 1899 he invented the Smith tilting mixer, which was later put on the market by the T. L. Smith Co.

* * *

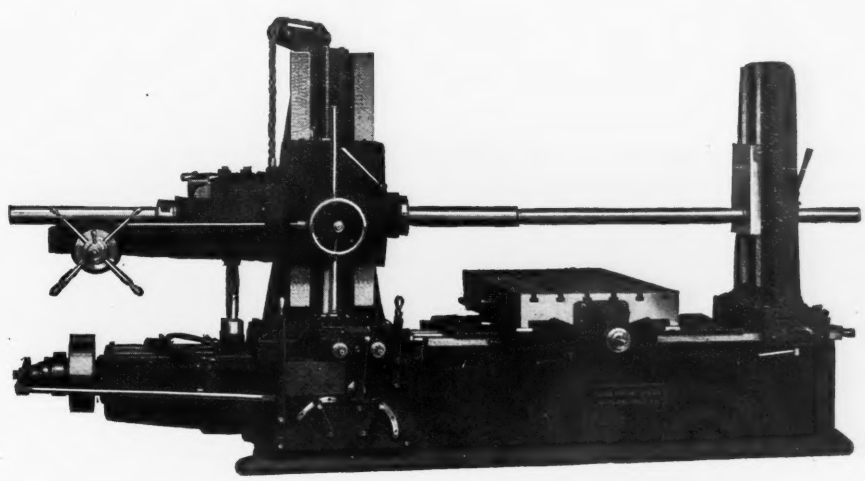
REGIONAL MEETINGS OF THE NATIONAL MACHINE TOOL BUILDERS' ASSOCIATION

Regional meetings have been held by the National Machine Tool Builders' Association in the west during the early part of May, which have developed a great deal of interesting material. This material will be presented to the members of the eastern section at a similar series of regional meetings, which will be held in Boston, June 1; Worcester, June 2; Hartford, June 3; and New York, June 7.

"In the majority of cases, the fewer words used, the better; let the goods talk for themselves."

The "PRECISION"

Boring, Drilling and MILLING MACHINE



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COMING EVENTS

June 15-16—Annual convention of the American Railroad Association (Section III-Mechanical) at Chicago, Ill.; headquarters, Hotel Drake.

June 20-24—Annual meeting of the American Society for Testing Materials, in Asbury Park, N. J.; headquarters, New Monterey Hotel. Secretary, C. L. Warwick, Philadelphia, Pa.

June 22-24—Annual joint convention of the American Drop Forge Association and the Drop Forge Supply Association in Chicago, Ill. Secretary, American Drop Forge Association, E. B. Horne, 1516 Helen Ave., Detroit, Mich.

September 14-16—Annual convention of the National Association of Cost Accountants in Cleveland, Ohio; headquarters, Hotel Cleveland. Secretary's address, 233 Woolworth Bldg., New York City.

September 19-24—Third annual convention and exhibition of the American Society for Steel Treating in Indianapolis, Ind. Secretary, W. H. Eisenman, 4600 Prospect Ave., Cleveland, Ohio.

September 28-October 8—New York Electrical Exposition at the 71st Regiment Armory, Park Ave. and 34th St., New York City. For information relating to exhibits, apply to Norman Maul, the Electrical Show Co., 130 E. 15th St., New York City, Room 828.

The sectional meetings of the American Society of Mechanical Engineers for June are as follows: **June 13-14**—Cleveland Section at Hotel Statler, Cleveland, Ohio; **June 17**—Inland Empire Section at Spokane, Wash.—joint meeting with engineering societies of Spokane; **June 28**—Atlanta Section at Georgia School of Technology, Atlanta, Ga.

SOCIETIES, SCHOOLS AND COLLEGES

Case School of Applied Science, Cleveland, Ohio. Booklet containing the presentation addresses of Worcester R. Warner and Ambrose Swasey of the Warner & Swasey Co., Cleveland, made upon the occasion of the presentation to the Case School of the Warner & Swasey astronomical observatory.

Manchester Municipal College of Technology, Manchester, England. Volume X of the Journal of the College of Technology, entitled "Technology," containing a record of investigations undertaken by members of the college during the year 1916. In the material presented are included articles on dynamo-electric machinery, distribution of frictional losses in internal combustion engines, strength and properties of cast iron, and trisecting an angle.

NEW BOOKS AND PAMPHLETS

Pyrometric Practice. By Paul D. Foote, C. O. Fairchild, and T. R. Harrison. 326 pages, 7 by 10 inches. Published by the Department of Commerce, Washington, D. C., as Technologic Paper No. 170 of the Bureau of Standards. Price, 60 cents.

Sweet's Engineering Catalogue. Seventh edition. 1251 pages, 8½ by 11½ inches. Compiled, edited, and published by Sweet's Catalogue Service, Inc., 119 W. 40th St., New York City.

This book represents a compilation of the catalogues of about 700 manufacturers. The field it covers is that of engineering and power plant equipment, and it lists materials, equipment, and supplies relating to the practical construction, equipment, and maintenance of all projects of an industrial or engineering nature. The material in the present edition is arranged more logically than in previous editions, and the products index has been revised and simplified, to enable any desired information to be more easily located.

Turret Lathe Practice. By Joseph G. Horner. 276 pages, 5½ by 8½ inches. Published by Emmott & Co., Ltd., 65 King St., Manchester, England. Price, 12s 6d.

The increasing importance of turret lathe practice has called forth the present treatise, which deals with the details of construction of the tools and various types of turret lathes. The machines shown are of English manufacture, and the author has attempted to select the best and most commonly used types. All the illustrations are line drawings, supplied by various concerns, it being considered that a better idea of the construction can be given by drawings than by halftone illustrations. The book discusses turret lathe operations in the following order: Turning, drilling, reaming, boring, screw-cutting, and work done from the cross-slide. One chapter is devoted to tool equipments, showing typical arrangements for different classes of work. The last three chapters deal with capstan and turret details, the headstocks, and collet chucks and wire feeds.

Descriptive Geometry Problems. By F. G. Higbee. 81 pages, 9 by 12 inches. Published by John Wiley & Sons, Inc., 432 Fourth Ave., New York City. Price, $1.50.

This book contains a collection of 218 problems in descriptive geometry to be worked out by the student. It is intended to be used as a supplement to any of the standard texts on descriptive geometry. Each proposition appears on a separate page, and these pages are arranged in loose-leaf form, so that they can be removed from the book, pinned to a drawing board, and the problem solved as indicated by the data given. The problems have been carefully selected to cover the general and special cases on which students need to be drilled. It is expected that the problems presented will provide the experience needed by students to master the fundamental principles of the subject. The author is professor and head of the department of descriptive geometry and drawing of the University of Iowa, and it is his belief that much is to be gained by the solution of problems given by descriptive data, and that sufficient work of this kind should be included as a part of a course in descriptive geometry to enable students to translate from descriptive to graphic form.

Questions and Answers Relating to Modern Automobile Design, Construction, Driving, and Repair. By Victor W. Page. 701 pages, 5¼ by 7½ inches. Published by the Norman W. Henley Publishing Co., 2 W. 45th St., New York City. Price, $2.50.

This is a new revised and enlarged edition of a book treating of the construction, operation, and repair of automobiles. The material is presented in the form of a series of thirty-nine lessons covering over two thousand questions and answers, relating to all branches of automobiling. The book has been written in a simple form with special reference to the requirements of the non-technical reader. The arrangement is logical, the discussion starting with the principal parts of the automobile, and continuing with the construction and operation of the engine, fuels, carburetion, etc., ignition systems, methods of lubricating, and typical cooling systems. Then follows a description of the transmission, clutch, gears, rear axles, etc., after which are taken up wheels and tires, bearings, and driving instructions, the remainder of the book being given up to repairing, and consideration of the troubles usually encountered in operating automobiles, with suggestions for their remedy. A separate chapter is devoted to electric starting and lighting systems.

Gas Torch and Thermit Welding. By Ethan Viall. 442 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., Inc., New York City. Price, $4.

The subject of welding as presented in this book, is divided into two parts, the first discussing gas torch welding, and the second thermit welding. The material relating to gas torch welding covers seventeen chapters treating of the history and uses of the gas torch; the production of welding gases; acetylene and medium-pressure generators; low-pressure acetylene and thermalene generators; gas torches used for welding; gas cutting torches; gas-pressure regulators and working assemblies; gas torch welding and cutting outfits; learning to weld with the gas torch; making allowance for expansion and contraction; welding various metals and the fluxes used; examples of welding jobs; welding jigs and fixtures; welding machines; cutting with the gas torch; cutting machines; and welding shop layout, equipment, and work costs. The part on thermit welding contains eight chapters covering the following subjects: Thermit welding: its history, nature, and uses; making plastic process welds; fusion welding of heavy sections; welding crankshafts, mill pinion teeth, etc.; welding new necks on large pinions and other heavy work; rail welding for electric systems; welding compromise rail joints; and welding cast-iron and other parts.

NEW CATALOGUES AND CIRCULARS

Genesee Mfg. Co., Rochester, N. Y. Circulars illustrating and giving specifications for Genesee inserted-blade, adjustable, face milling cutters, hollow-mills, and spot-facers.

Hergi Mfg. Co., 250 Fifth St., Bridgeport, Conn. Circular illustrating and describing Hergi flexible shaft equipment, especially adapted for grinding, chipping, and screwdriving.

United States Blueprint Paper Co., Chicago, Ill. Circular of Richter drawing instruments, containing price lists of compasses, ruling pens, bow pens, bow pencils, bow spacers, dividers, etc.

Meldrum - Gabrielson Corporation, Syracuse, N. Y. Circular announcing the new Syracuse adjustable limit snap gage, containing descriptions, illustrations, and a table giving range of sizes and list prices.

Northern Engineering Works, Detroit, Mich. Bulletin 508, descriptive of the Northern Type E three-motor electric traveling crane. The circular also contains illustrations showing applications of this crane.

Tomkins-Johnson Co., Jackson, Mich. Circular giving dimensions of the different sizes of Melling universal vise, which can be set at any angle from 0 to 45 degrees, in any direction, either simple or compound.

H. M. Lane Co., Owen Bldg., Detroit, Mich., industrial engineers and foundry specialists, are issuing a monthly publication entitled "The Foundry World," containing material relative to foundry methods and equipment.

Madison Mfg. Co., Muskegon, Mich. Circular descriptive of the Madison adjustable boring tool for both rough- and finish-boring, which is so designed as to be quickly adjusted to size, and which operates with a heavy feed.

Steel Products Engineering Co., Springfield, Ohio. Circular illustrating and describing the Averbeck back-geared balanced ram shaper, which is made in two types, each of which are furnished in 17- and 21-inch sizes.

Hart Roller Bearing Co., Orange, N. J. Circular entitled "Value Versus Competition," describing in detail the construction of the Hart staggered roller bearings, and outlining the advantages of this type of construction.

General Electric Co., Schenectady, N. Y. Bulletin 42201-B, treating of Curtis steam turbines of from 100 to 3500 kilowatts capacity, which have been developed for driving 60-cycle generators at 3600 revolutions per minute.

Denver Rock Drill Mfg. Co., Denver, Col. Circular illustrating and describing the "Waughoist," an air-driven portable hoist for use in building operations, mining operations, shaft-sinking operations, contracting work, foundry work, etc.

J. H. Williams & Co., 61 Richards St., Brooklyn, N. Y. Circular containing tables of capacities, dimensions, prices, etc., of "Vulcan" pipe fitters' tools, including drop-forged chain pipe wrenches, pipe vises, pipe-vise mounts, pipe-vise clamps, etc.

Pawling & Harnischfeger Co., 38th and National Aves., Milwaukee, Wis. Pamphlet SX, containing data relative to the construction of a new shovel attachment made for use with Pawling & Harnischfeger Types 205 and 206 excavator cranes.

Franklin Machine & Tool Co., Springfield, Mass. Circular descriptive of the Franklin universal grinder, which is a portable repair shop unit, especially adapted for grinding valves, reseating cutters, reamers, breaker contacts, screw points, and similar parts.

Baker R & L Co., Cleveland, Ohio. Bulletin 10, descriptive of the Baker Series C industrial tractors and trucks with duplex compensating suspension. This feature of the design is described in detail and illustrated with both halftone and line illustrations.

Root Co., Bristol, Conn. Catalogue 31, entitled "Census Takers of Industry," illustrating the various types of automatic counters made by this company and their application for counting the product in a wide variety of industries. Copies of the book will be sent upon request.

Osborne & Sexton Machinery Co., Columbus, Ohio. Circular listing the features of construction of the Osborne-Sexton shaper, which is equipped with double-face main driving gears so that in case one gear is broken it will still be possible to operate with the other.

Sprague Electric Works of General Electric Co., 527-531 W. 34th St., New York City. Bulletin 48967, containing an outline of the features of Sprague electric hoists, and tables of ratings and weights of the different sizes. The hoists shown range in capacity from ¼ ton to 6 tons.

Schatz Mfg. Co., Poughkeepsie, N. Y. Catalogue 6, containing descriptions, tables of load capacities, mounting instructions, and other data relating to the line of "Commercial" annular ball bearings made by this company, which includes the less expensive grades of annular ball bearings.

Golden Co., 405 Lexington Ave., New York City. Catalogue 7, of R. B. F. ball bearings made by the Cie d'Applications Mecaniques, Societe Anonyme, of Paris, France. The book contains a tabulated list of ball and roller bearings, and thrust bearings in English and metric sizes.

Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio. Circular entitled "Guaranteed Service at a Fair Price with Cincinnati Lathes," containing description and illustrations of the cone type and geared-head lathes made by this concern, which are furnished in 16-, 18-, 20-, 22-, 24-, 26-, and 28-inch sizes.

Birmingham Tool & Gage Co., Grove St., Winson Green, Birmingham, England. Export catalogue for 1921 covering the line of small tools made by this concern, which includes high-speed steel milling cutters, reamers, drills, hack-saw blades, gages, gear-cutters, saws, etc. Illustrations and tables of dimensions and prices are included for each tool.

Fox Machine Co., Jackson, Mich. Circular illustrating and describing the details of construction of the Fox No. D-22 multiple tapping and

drilling machine, which consists of the Fox D-22 type of multiple-spindle drilling machine equipped with a tapping attachment. The same type of construction is used on the Fox D-12, D-32, and D-42 machines.

Syracuse Belting Co., 406 S. Franklin St., Syracuse, N. Y. Circular of "Nu-bilt" belting, which is made from scrap leather belt. By the process employed by this concern old oil-soaked belting is reclaimed by extracting the oil and grease, repairing and reinforcing with a solid woven cotton backing, securely cemented, thus making a double belt.

John Bath & Co., Inc., Worcester, Mass. Bulletin 10, descriptive of the Bath internal micrometer and master reference gage, a new tool for the rapid measurement of holes in production work, and for the accurate inspection of gages. The circular contains twelve pages of information relative to hole measurement and covering the stock sizes of micrometers.

Lima Drill Press Co., Lima, Ohio. Pamphlet containing a detailed description and specifications covering the design and construction of the new Lima multiple-spindle magazine drilling machine, which is equipped with a magazine having sixteen spindles that acts as a drill rack for sixteen different sized drills, each of which can be quickly brought into position for immediate use.

Ingersoll Milling Machine Co., Rockford, Ill. Circular showing some representative Ingersoll planer type milling machines, including three-head adjustable-rail machine, six-head double-faced fixed-rail machine, horizontal-spindle machine, and three-head single-faced fixed-rail machine. This circular also shows the Ingersoll cutter grinder, which grinds milling cutters at a single setting.

Precision & Thread Grinder Mfg. Co., 1 S. 21st St., Philadelphia, Pa. Circular illustrating and describing the precision thread lead variator made by this company, which is intended to be used in conjunction with the company's thread grinder, for producing threads with precision leads. The leaflet is intended to be inserted in the loose-leaf catalogue of the multi-graduated precision grinder.

Expanding Gage Co., Dayton, Ohio. Pamphlet entitled "Hole Precision," descriptive of the expanding plug gages made by this concern, which are marketed in a standard set of twenty-four instruments, ranging from 1/2 inch to 2 inches, or for any range of measurements. These gages are particularly useful for locating two or more holes in a piece of work, but may also be used for any purpose for which a solid gage is used.

Alfred Box & Co., Inc., Philadelphia, Pa. Bulletin 3000, containing tabulated data covering dimensions, capacities, etc., of Box electric traveling cranes, as well as descriptive material relating to the details of design, materials, shop practice, and safety appliances. The latter part of the book contains illustrations showing installations of these cranes that give an idea of the variety of industries for which they are adapted.

Frank G. Payson Co., 9 S. Clinton St., Chicago, Ill. Bulletin R 12 containing descriptions, illustrations, and specifications of the Logan air-operated chucks, which are made in two-jaw, three-jaw, and collet types. This bulletin also shows other air-operated equipment produced by the concern, including air-operated drilling vise, compensating piston turning equipment, double-acting air cylinders, and special air-operated milling fixture.

Carlyle Johnson Machine Co., Manchester, Conn., has published a stock list covering a comprehensive assortment of sizes in which the Johnson friction clutch can be obtained immediately from stock. The company announces that it is now in a position to supply Johnson friction clutches in either single or double type, for any dimensions of pulley or shaft, and for any horsepower requirements within the range ordinarily covered.

Norton Co., Worcester, Mass. Catalogue (printed in two colors) of Norton grinding machines. General descriptions, illustrations, and specifications are given for Norton Types A and B cylindrical grinding machines; open-side surface grinding machines; car-wheel grinding machines; universal tool and cutter grinding machines; multi-purpose grinding machines; roll grinding machines; running balance indicating machines; and grinding wheel stands.

Porter-Cable Machine Co., Syracuse, N. Y. Catalogue illustrating and describing in detail the Porter-Cable lathe for intensive manufacturing and the rapid production of duplicate parts. The various attachments made for the machine, such as the facing attachment, taper attachment, screw-cutting attachment, flat center tailstock, and milling attachment, are also illustrated and described. Examples of multiple tooling for different classes of rapid production work are illustrated.

Diamond Chain & Mfg. Co., Indianapolis, Ind. Pamphlet containing charts, formulas and rules compiled for engineers and designers as an aid in the selection of chain drives, Diamond sprockets, and sprocket cutters. The tables presented give dimensions, revolutions per minute, weight, average breaking strength, and other data for roller chains and block chains; maximum horsepower for Diamond chains at different velocities; maximum working loads at different velocities; and allowable chain velocities for different numbers of teeth.

Haynes Stellite Co., 30 E. 42nd St., New York City, is issuing a series of books designated as a reference library, containing data on stellite practice. The books are published in convenient pocket size and contain specific facts concerning the qualities of stellite as a cutting metal and production records established with stellite tools. The properties, uses, and applications of this metal, the principal characteristic of which is that it cuts at a red heat, are fully explained, and cutting speed charts and considerable other useful tabular material are included. Volumes 9 and 10 of the series, which have just been issued, deal, respectively, with stellite bar stock and stellite welded-tip tools. Copies of these books may be obtained upon request.

Joseph T. Ryerson & Son, 16th and Rockwell Sts., Chicago, Ill., have published a book on the heat-treatment of alloy steels entitled "Ryerson Handbook on Alloy Steels." The book is written by G. Van Dyke, manager of the alloy steel department, and covers the manufacturing methods, heating, drawing, annealing, casehardening, etc. An idea of the treatment will be gained from a list of the following chapter headings: Quality (Analysis not the only Factor); Method of Manufacture; Elements and the Part they Play; How to Buy and Select Alloy Steels; Shop Equipment; Furnaces; Quenching Equipment; Heat Measurement; Heating; Cooling and Quenching; Drawing; Annealing; Testing Heat-treated Steel; and Casehardening or Carburizing. This book is not generally circulated, but will be sent without charge to buyers and users of alloy steels upon request.

TRADE NOTES

International Nickel Co., has removed its offices to 67 Wall St., New York City.

Pittsburg Stamp Co., Inc., has moved its office and factory from 316 Penn Ave. to 811-817 S. Canal St., N. S., Pittsburg, Pa.

Nelson Tool & Machine Co., Inc., has moved from 82 Llewellyn Ave., Bloomfield, N. J., to new quarters at 52-56 Lafayette St., Newark, N. J.

Motch & Merryweather Machinery Co., Cleveland, Ohio, has taken over the sales of the Gordon cam turning lathe, which is now being manufactured by the Willard Machine Tool Co., of Cincinnati, Ohio.

Monitor Controller Co., Baltimore, Md., manufacturer of the Monitor system of automatic control for motor-driven apparatus, has established a Cleveland office at 420 Permanent Bldg., in charge of Robert Notvest.

Mesta Machine Co., Pittsburg, Pa., announces the removal of its Chicago office from the temporary location in the Railway Exchange Building to permanent quarters in the McCormick Building, Michigan Boulevard.

Wickes Bros., Saginaw, Mich., manufacturer of heavy-duty engine lathes, blueprinting machines, plate-working tools, and special production machinery, has opened a New York office at 501 Fifth Ave., New York City, with Albert E. Braun as manager.

Chicago Belting Co., 127 N. Green St., Chicago, Ill., has established a direct factory branch at 327 Second Ave., Pittsburg, Pa., which will be under the management of the Machinists' Supply Co. of the same address. A complete stock of leather belting and belting accessories will be carried by the Pittsburg branch.

Superior Die Casting Co., Cleveland, Ohio, has opened a branch sales office at 1250 Book Bldg., Detroit, Mich., under the management of F. L. Neward and M. F. McManus. The company has also opened a branch sales office at 1405 Real Estate Trust Bldg., Philadelphia, Pa., under the management of D. B. Wilson and C. D. Ensign.

Reed & Prince Mfg. Co., Worcester, Mass., has opened a new store and warehouse at 121 N. Jefferson St., Chicago, Ill. The stock carried at the new warehouse will comprise a full line of wood screws, machine screws, cap-screws, set-screws, stove bolts, nuts, and small rivets. The Chicago branch will be under the management of J. V. Banks.

Green Engineering Co., East Chicago, Ind., announces the opening of an eastern office at 85 Liberty St., New York City. This office will be under the management of W. S. Burke, who has been elected eastern manager. Mr. Burke has been with the company for more than nine years. He will have supervision over all the eastern and foreign business.

Jas. Clark Jr., Electric Co., Inc., Louisville, Ky., announces that out of twenty-three bids submitted to the Air Service Division of the War Department at Washington, D. C., the Jas. Clark, Jr., Electric Co. was awarded an order for 145 "Willey" portable electric drills. The Department required samples to be submitted for test as to design, material, workmanship and weight.

Societe Anonyme Belge Alfred Herbert, Brussels, Belgium, has moved into new quarters at 34 Rue Melsens. The new premises have liberal showroom accommodation. The building was originally erected for A. H. Schutte, and since the armistice has been occupied by the Allied Machinery Co. of America. The managing director is R. H. Lowe, and the sales manager, J. Bourdouxhe.

Hauck Mfg. Co., Brooklyn, N. Y., manufacturer of oil burners, oil forges, oil burning appliances, and allied equipment, elected the following officers at a recent meeting of the stockholders and directors: President, Henry T. Gerdes; first vice-president, M. C. Hauck; second vice-president, A. B. Hauck; third vice-president, H. H. Kress; treasurer, A. H. Stein; and secretary, J. Lutz.

J. Horstmann, 81 Rue Saint-Maur, Paris, France, machine tool dealer, has been succeeded by the Etablissements Horstmann. The following are the officers of the new concern: President, J. Horstmann; managing director, J. Welter; director, H. Nourry, manager of the machine tool department; director, E. Barbier, manager of the small tool department. No change has been made in the organization of the firm.

H. C. Giles Corporation, 303 Cox Bldg., Rochester, N. Y., has been organized to engage in the manufacture of a trip-hammer staking machine, designed for use on cupped or drilled rivets, studs, screws, etc., for staking or riveting them to parts, or in fastening two or more parts together. The firm will also manufacture cupped rivets, studs, screws, etc., which can be furnished in connection with the staking machine.

Cincinnati Grinder Co., Cincinnati, Ohio, has recently placed the sale of its line of grinding machines on an exclusive basis with the Marshall & Huschart Machinery Co. in the Chicago district; Motch & Merryweather Machinery Co. in the Cleveland, Cincinnati, Pittsburg, and Detroit district; and Henry Prentiss & Co. in the New York and New England district. The company will also maintain its own grinding specialists in the respective territories.

Philadelphia Gear Co., Philadelphia, Pa., has moved into a new plant at Tioga and Richmond Sts. This move became necessary because of the expansion of the company's gear business. The new building is of modern, one-story construction, having a total of approximately 20,000 square feet of floor space. The plant is equipped with a 15-ton crane and has a railroad siding within the building. The office of the company will still be retained at the Vine St. address.

Uehling Instrument Co., 2000 Empire Bldg., New York City, manufacturer of fuel-saving equipment, has moved its Chicago office to the Great Northern Bldg., at 20 W. Jackson Blvd. Uehling carbon dioxide recording equipment and other boiler room instruments will be on display at this office. Walter C. Lange has been appointed manager of the Chicago office. Mr. Lange was formerly stationed at the New York office of the company, and has had considerable experience in this field.

Black & Decker Mfg. Co., Towson Heights, Baltimore, Md., has opened a Kansas City branch at 1711 Grand Ave. This branch includes Kansas, Nebraska, Oklahoma, Texas, Arkansas, western Louisiana, and western Missouri. J. N. La Belle, formerly assistant manager of the Chicago branch, will have charge of the Kansas City branch, and will be assisted by Emery Harris, who will make his headquarters in Omaha, Neb., and R. Brice Shipley, who will cover the territory of Oklahoma, Texas, Arkansas, and western Louisiana.

Post Tractor Co., Cleveland, Ohio, and the **Whitney Tractor Co.**, Upper Sandusky, Ohio, have been consolidated under the name of the Post-Whitney Co., of Cleveland, Ohio. The company is capitalized at $10,000,000, and the officers are as follows: President, E. B. Cassatt; vice-president, A. B. Whitney; vice-president, C. B. Post; treasurer, A. J. Tuscany; and secretary, F. R. LePage. The company will maintain the plant at Cleveland, where the Post tractor will be manufactured, as well as the Whitney plant at Upper Sandusky where the Whitney tractor is being built.

Manufacturers' Exhibition Co., Inc., has been established at 45 W. 18th St., New York City, to offer manufacturers of machinery and mechanical appliances the advantage of a permanent display and sales room, where their machines can be shown in operation. The building occupied is that formerly known as the Greenhut Bldg. Each floor contains approximately 85,000 square feet of floor space, and has a floor load of 190 pounds per square inch. A general information bureau and reading room will be maintained, where trade journals and technical papers, as well as catalogues, will be kept on file. The president and general manager of the company is L. R. Duffield.